

DURHAM



City of Durham “Reference Guide
for Development” Provided by the:
Public Works Engineering
Division, Public Works
Stormwater Services Division and
Department of Transportation

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CITY OF MEDICINE

City of Durham Public Works Department

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DIRECTORY

These are the most commonly referred to numbers that are involved in development plans.

	Telephone (919)	Fax (919)
City of Durham (http://www.durhamnc.gov/)		
Public Works Department		
Engineering Development Review Group: <i>Engineering plan review, construction drawing approval, extension agreements</i>	560-4326	560-4316
Inspection Section: <i>waterlines, sanitary sewer, storm sewer, right-of-ways</i>	560-4326	560-4316
Engineering Services: <i>water and sanitary sewer availability, petitions, water meters, frontage and tapping fees, water and sewer permits</i>	560-4326	560-4316
Stormwater Services: <i>Stormwater design review, BMP inspections</i>	560-4326	560-4316
Street Maintenance	560-4312	560-4340
Department of Transportation: <i>Traffic impact analysis, roadway improvements review</i>	560-4366	560-4561
Water Management Department:		
Water and Sanitary Sewer Maintenance	560-4344	560-4340
Cross Connections: <i>Backflow devices</i>	560-4194	
Solid Waste Management Department: <i>Dumpster locations</i>	560-4186	560-1228
Urban Forestry: <i>Street trees and allowed landscaping within ROW</i>	560-4197	
Parks and Recreation Department	560-4355	560-4021
Budget Management Department: <i>Annexation petitions</i>	560-4111	560-4687
Joint City/County Offices		
Building Inspection Department: <i>Building permits, fire protection</i>	560-4144	560-4484
Planning Department: <i>Zoning requirements, rezoning, site plans, final plats</i>	560-4137	560-4641
County of Durham (http://www.co.durham.nc.us/)		
County Engineering		
Utility Division: <i>County sanitary sewer</i>	544-8832	544-8590
Sedimentation & Erosion Control Division: <i>Grading permit</i>	560-0739	560-0740
Fire Marshal	560-0660	560-0670
Environmental Health: <i>Well and septic permits</i>	560-7800	560-7830
State of North Carolina		
North Carolina Department of Transportation (NCDOT)		
District 2 Engineer – Durham County	220-4750	560-3357
Resident Engineer's Office - Durham	220-4680	560-3399
North Carolina Department of Environment and Natural Resources (NCDENR)		

Raleigh Regional Office	791-4200	571-4718
Collection Systems Permitting (sanitary sewer)	807-6300	807-6489
NC Ecosystem Enhancement Program	715-0476	715-2219
U.S. Army Corps of Engineers Wilmington District		
Raleigh Regulatory Field Office	554-4884	562-0421

Utility Companies

Progress Energy	508-5400 or 1-800-452-2777
Duke Energy	1-800-653-5307
Piedmont Electric	1-800-222-3107
Time/Warner of Durham	595-4892 or 1-888-890-7515
Public Service Gas	1-877-776-2427
NC One Call (Utility Locating Company)	811
Verizon	1-800-483-4000

INTRODUCTION

We are pleased to distribute to design professionals this Reference Guide for Development. The City of Durham Public Works Department, Engineering, Stormwater Services and Transportation Divisions, prepared this guide to provide a reference manual to some of the City of Durham Public Works Department's design standards and design requirements and to reference other key Departments involved in the Development Review Process. This guide does not cover all aspects of plan review or design requirements and references only the most frequently asked questions and procedures. The policies, requirements, specifications and charges listed herein are subject to change as amended.

It should be noted that projects may be required to meet additional criteria as set by the Durham City Council or the City of Durham Public Works Department. The City of Durham reserves the right to require any additional measures in accordance with City Codes, ordinances, policies and to address public safety concerns during any stage of the project.

There are detailed construction specifications for water, sanitary sewer, street and stormwater construction that are available from the Engineering Division of the Public Works Department.

If you have questions regarding the City of Durham Engineering Division's or Stormwater Services Division's procedures or policies not addressed in this guide, please contact the Divisions (919-560-4326). If you have questions regarding the City of Durham Transportation Division's procedures or policies not addressed in this guide, please contact the Division (919-560-4366).

PREFACE TO THE UPDATE OF THE REFERENCE GUIDE FOR DEVELOPMENT

As an ongoing effort to provide better customer service to all parties involved with land development in Durham, the Public Works Department has undertaken the task of updating and revising this manual. Much of the initial printing remains the same but numerous issues, including those highlighted below, have been revisited and revised.

Summarized below are the major changes and additions to this guide. This summary is provided to give a "thumbnail sketch" of the revisions. We have elected not to highlight changes throughout the manual. This new version of the Reference Guide for Development supersedes all previous versions.

Section Revision Description

- 1.2 Checklists have been revised and final plat checklists are now required to be submitted.
- 2.1 Clarifications as to when construction drawings can be submitted for review.
- 2.2 Clarification to Construction Submittal Checklist for site plan requirements to submit construction drawings.
- 2.3 Addition of requirement for Project Construction Information sheet to be submitted at time of Pre-Construction Conference.
- 4.0 Clarification of As-built requirements - Addition of a electronic file component for As-builts
*(this program will begin January 2007 – see statement on the Public Works website)
- 4.1 Revised as-built requirements for the BCE Program.
- 4.2 Revised as-built requirements for the BCE Program.
- 4.3 Revised as-built requirements for the BCE Program.
- 4.4 Revised as-built requirements for the BCE Program.
- 4.5 Constructed Wetland As-built Requirements
- 4.6 Underground Detention As-built Requirements
- 5.0 Requirements in order to obtain a water meter revised.
- 7.0 Clarification of Easement location requirements. Requirements in order to obtain a sewer service connection revised.
- 8.0 Multiple updates
- 8.1 Multiple updates
- 8.2 Multiple updates
- 8.3 Multiple updates
- 8.4 Multiple updates
- 12.0 Addition of new note requirement for all site plans.
June 2010 Revision:
 - 1.1 Revised Engineering Final Plat Checklist
- 14.0 Updated Engineering Fees

SECTION 1.0

PUBLIC WORKS DEPARTMENT

ENGINEERING AND STORMWATER SERVICES DIVISIONS AND DEPARTMENT OF TRANSPORTATION AND THE REZONING, SITE PLAN, PRELIMINARY PLAT AND FINAL PLAT PROCESS

The following information is to provide a basic overview of the roles of the above divisions as they relate to the site plan and plat review process. However it should clearly understood that all correspondence, plan submittals and status inquiries associated with these processes **must always** be directed to the Durham City/County Planning Department. All documents that are not received through the Durham City/County Planning Department will not be considered as a valid submittal and will not be reviewed accordingly by any Division.

ENGINEERING DIVISION:

The City of Durham Engineering Division is located on the 3rd floor of City Hall. The Development Review Group is the main contact in the Engineering Division for all Engineering comments that are returned on rezoning, site plans and final plats. The Development Review Group can be contacted by mail at the following address: Public Works Department, City of Durham, 101 City Hall Plaza, 3rd Floor, Development Review Group, Durham, North Carolina, 27701. The contact phone number for questions is (919) 560-4326 and fax number is (919) 560-4316.

The City of Durham Engineering Division is tasked with reviewing rezoning, site plans and preliminary plats as these items relate to the City of Durham public and private road standards, sidewalk, water system, fire protection systems, sanitary sewer system and stormwater drainage and conveyance systems. The City of Durham Engineering Division is also tasked with reviewing final plats as they relate to roadway rights-of-way, water systems, storm drainage conveyance systems, sanitary sewer systems and related easements.

The typical time line for review of rezoning, site plan and plats is determined by the Planning Department. The typical time line for review of all resubmittals is determined by the Planning Department.

STORMWATER SERVICES DIVISION:

The City of Durham Stormwater Services Division is located on the 3rd floor of City Hall. The Stormwater Services Division is the contact in the Public Works Department for all stormwater impact analysis comments that are returned on rezoning, site plans and final plats. The Stormwater Services Division can be contacted by mail at the following address: Public Works Department, City of Durham, 101 City Hall Plaza, 3rd Floor, Stormwater Services Division, Durham, North Carolina, 27701. The contact phone number for questions is (919) 560-4326 and fax number is (919) 560-4316.

The City of Durham Stormwater Services Division is tasked with reviewing rezoning, site plans and preliminary plats as these items relate to stormwater impact studies, stream buffers (along with City/County Planning Department), floodplain analysis, stormwater quality facilities and stormwater quantity facilities, as well as major stream crossing systems. The City of Durham Stormwater Services Division is also tasked with reviewing plats as they relate to floodplain issues, stream buffers (along with City/County Planning Department) and stormwater easements for water quality and quantity facilities.

The typical time line for review of rezoning, site plan and plats is determined by the Planning Department. The typical time line for review of all resubmittals is determined by the Planning Department.

DEPARTMENT OF TRANSPORTATION:

The City of Durham Transportation Division is located on the 4th floor of City Hall. The Transportation Division is the contact in the Public Works Department for Transportation comments that are returned on rezoning, site plans, and final plats. The Transportation Division can be contacted by mail at the following address: Public Works Department, City of Durham, 101 City Hall Plaza, 4th Floor, Transportation Division, Durham, North Carolina, 27701. The contact phone number for questions is (919) 560-4366 and fax number is (919) 560-4561.

The City of Durham Transportation Division is tasked with reviewing rezoning, site plans and preliminary plats as these items relate to proposed public rights-of-way, cross-sections on proposed/existing roads, preserving the most current Durham Area Thoroughfare Plan (possible right-of way dedication and/or upgrade of the existing infrastructure), preserving the Bicycle Area Plan, placement of sidewalk, sight distance triangles, vehicular and pedestrian accesses, site traffic analyses (if necessary), interconnectivity of developments, and points of access. The City of Durham Transportation Division is tasked with reviewing final plats as they relate to proper public rights-of-way or private accesses (easements) and conforming to street naming convention for signage.

The typical time line for review of rezoning, site plan and plats is determined by the Planning Department. The typical time line for review of all resubmittals is determined by the Planning Department.

SECTION 1.1

ENGINEERING DIVISION, SITE PLAN, PRELIMINARY PLAT AND FINAL PLAT SUBMITTAL REQUIREMENTS

The following section provides a list, which should be used by the applicant before any site plan, preliminary plat or final plat submittals so that the applicants are aware of the minimum requirements in order to receive a complete review. The checklists in this section are intended as a guide and are not a submittal requirement with plans.



***City of Durham
Public Works Department
Engineering Division***

101 City Hall Plaza, Durham, North Carolina, 27701
Telephone (919) 560-4326 FAX (919) 560-4316

Engineering Site Plan and Preliminary Plat Submittal Checklist

The following is a list of standard site plan and preliminary plat requirements that are reviewed by the City of Durham Engineering Division at the Site Plan and Preliminary Plat Stage of Development Review. This list is intended to give general guidelines only and is not to be considered all-inclusive. Depending upon the development additional items may be required. Site Plan and Preliminary Plat submittals without the following minimum criteria will be returned to the applicant without a complete review being performed thus resulting in additional delays to the site plan and preliminary plat process until the information is provided.

I. PROJECT INFORMATION

Project Name: _____ Phase: _____
Previous Project Name, if applicable: _____
PIN: _____ Tax Map Number _____ Planning Case Number: _____
Project Comment Contact Person: _____ Phone number () _____
Fax number: () _____ Company Name: _____

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines submittal requirements. Initial in the space provided to indicate the following submittal requirements have been met.

A. General Requirements (Cover Sheet)

Applicant's initials (typical all sections)

- _____ a. Show all of the following items on the Cover sheet: date (original and all revisions), north arrow with reference, project name, vicinity map, PIN, and Tax Map Number.
- _____ b. Provide an index map with match lines for multiple sheets for all plans as needed.
- _____ c. Provide the name, address, telephone number, facsimile number, and email address if applicable of all professionals with a seal, signature and date.

B. Existing Site Conditions (Existing Conditions)

- _____ a. Provide a north arrow with reference and an engineering/graphic scale (1"=200' max).
- _____ b. Show all property boundaries with linear bearings and distances, curve boundary information (table format – curve number, radii, length, delta angle, chord bearing and chord distance) and the building setbacks. State the source of the provided boundary information.
- _____ c. Show all existing property lines, which are to be removed and label them as "Hereby removed".
- _____ d. Show all adjacent parcels with the graphical angle of departure of adjacent property lines.

- _____ e. Show all buildings and structures and label current use/facility name and finished floor elevation.
- _____ f. Show all pavement, parking and driveway access points on the property.
- _____ g. Show all walkways/sidewalks/handicap ramps both adjacent to the development and opposite any existing roadways or intersections.
- _____ h. Show all adjoining/opposing streets and alleys with names, rights-of-way and pavement widths, state route numbers, labeled as “Existing” and “Public” or “Private”. Note any streets, alleys or rights-of-way that are unopened. All existing features and improvements (driveways, sidewalk, hydrants, light poles, etc.) must be shown that exist between the right-of-way lines.
- _____ i. Show all water lines, sanitary sewer lines, services, cleanouts, valves, hydrants within 500 feet, water meters and vaults, backflow preventers, storm sewer systems, catch basins, headwalls, junction boxes, other structures, ditches and swales. Label all sizes, widths, inverts and type of material (if known) information for all items.
- _____ j. For existing services or mains provide abandonment notes for water and sanitary sewer services which are being abandoned.
- _____ k. Show and label all easements, both public and private with location and width. Define all easements by centerline bearings, distances and ties to property corners or page book and deed reference.
- _____ l. Show all topography with a maximum of two-foot contour intervals for the development. Provide notes that indicate references to any permanent benchmarks, accepted datum, and source data. Durham topography maps may be used but it is recommended to obtain field topography.

C. Proposed Development (site plan or preliminary plat sheet)

- _____ a. Clearly distinguish graphically between existing features and proposed features.
- _____ b. Show all proposed property lines.
- _____ c. Show all areas to be dedicated or reserved for public or private use and define with property lines or easements.
- _____ d. Show all building setback lines.
- _____ e. Clearly define the footprints of proposed buildings.
- _____ f. Define with details typical roadway cross-sections for all proposed public or private streets/alleys. Details should include typical pavement structure, size of curbing, shoulders, sidewalks, pavement widths and right-of-way widths as applicable.
- _____ g. Clearly show on the proposed site plan all pavement and right-of-way widths to correspond to details and label right of ways as ‘Public’ or ‘Private’.
- _____ h. Provide new street centerline radius to show that streets will meet City of Durham standards.
- _____ i. At the end of all street stubs to adjacent properties provide a temporary turnaround as instructed by City of Durham Engineering Division.
- _____ j. Clearly indicate new parking areas, proposed driveways with radii and width, and valley gutters.
- _____ k. If a townhome development is proposed and the streets are designed with parking on both sides provide the standard townhome note per the Reference Guide for Development. The

pavement designs however must meet the City of Durham minimum road sections for residential streets.

- _____ l. If required to install sidewalk along the frontage of the property by the City of Durham Transportation Division, all sidewalk shall be shown at the back of right of way. Handicap ramps shall be provided at all driveways and intersections and shall match existing handicap ramps and crosswalks for access. Note any request for payment-in-lieu of sidewalk construction must be reviewed by the City of Durham Engineering and Transportation Division prior to approval by DRB (all requests for payment-in-lieu should be submitted in writing with the site plan submittal for review). If approved by DRB the applicant is required to state in the special conditions box of approvals the following statement: "The applicant has requested approval from DRB to make a payment-in-lieu for the sidewalk along some or the entire frontage of this project. This was approved by DRB on (provide date of approval). The applicant agrees to make the payment-in-lieu of sidewalk (amount of payment and length of sidewalk to be determined by the Public Works Department) when the applicant pays the City of Durham Engineering Division Inspection fees. If no inspection fees are required the applicant agrees to make the payment-in-lieu of sidewalk before the 1st certificate of occupancy will be issued."
- _____ m. Show all internal sidewalks and provide handicap ramps per City of Durham standards. All internal sidewalks shall connect to sidewalks in the public right-of-way.
- _____ n. Provide typical detail and a note in special conditions box stating driveway lengths shall be no less than 20' measured from right-of-way line or street easement line as applicable for residential projects.

D. Proposed Development (grading plan sheet)

- _____ a. Provide preliminary grading for all proposed projects (including subdivisions, which intend to utilize lot by lot grading). Provide contours at a maximum of two-foot contour intervals. (**Note:** Statements that grading plans will be submitted at construction drawing submittal will not be accepted).
- _____ b. Provide a preliminary storm drainage layout plan, which shows basic storm drainage locations. Preliminary pipe sizes are not required on internal storm drainage systems at site plan stage.
- _____ c. Provide preliminary storm drainage easement sizes and locations. All storm drainage lines and easements should be located in open space as much as possible. Storm drainage easements cannot be shown as combined easements. The Engineering Division suggests that final plats should not be submitted until after construction drawings have been approved so that all easement locations will be correctly shown and dedicated.
- _____ d. Provide typical sections for proposed surface drainage (ditches, swales, special features, etc).
- _____ e. Label all retaining walls with preliminary top of wall and bottom of wall elevations.
- _____ f. Provide finished floor elevations for all structures (buildings, concrete pads, pump stations, etc).
- _____ g. Show sanitary on grading sheet or provide sheet showing contours and sanitary sewer.

E. Proposed Development (utility plan sheet)

- _____ a. Show and label all water and sanitary sewer lines as public or private. Preliminary sizes can be shown but are not required.
- _____ b. Waterlines shall be located on the north and east side of roadways and sanitary sewer lines shall be located on the south and west side of roadways. All sanitary sewer outfalls shall be located in open space or common areas as much as possible.
- _____ c. All sanitary sewer and waterlines shall provide for connectivity to adjacent properties as required or directed by the City of Durham Engineering Division.
- _____ d. Show all water and sanitary sewer easements (combined easements are not allowed, but overlapping easements are acceptable).
- _____ e. Show all valves, manholes, sanitary sewer cleanouts, hydrants, meters with sizes (1 ½" or larger in vault with 4" PVC drain, shown on plan). Sanitary sewer cleanouts located in traffic areas shall be labeled as traffic bearing cleanouts.
- _____ f. Show all services at right-of-way line behind sidewalk if applicable. Show all backflow prevention devices needed outside of the right-of-way (in vault with 4" PVC drain or above ground hot box).
- _____ g. All food service dumpsters and compactors are required to have drains to a sanitary sewer. Dumpster pads shall be designed to not allow any other surface drainage into sanitary sewer.
- _____ h. If a sanitary sewer force main is proposed add a note stating that force main shall be ductile iron pipe per City of Durham Standards with a *Protecto 401* or equal lining. This is only required where water column separates from pipe and creates an air pocket (at high points with air release valves).
- _____ i. If a site is using a well and proposes to provide a sanitary sewer service for project add a note stating a standard water meter is required to be installed on well for sanitary sewer billing purposes.

F. Proposed Development (Landscape plan)

- _____ a. Show and label all easements (water, sanitary sewer and storm drainage conveyance systems).
- _____ b. Remove all proposed vegetation in rights-of-way and easements.
- _____ c. Where indicated by the City of Durham Engineering Division remove any existing or proposed landscaping in existing or future easements (if applicable to project).
- _____ d. Show water/sewer/SD to show any conflicts caused by landscaping

G. Proposed Development (Special Conditions of Approval Box)

- _____ a. In the special conditions of approval box, always add the following notes:
 - 1. All sizes, materials, slopes, geometry, locations, evaluations, extensions and depths for all existing and proposed streets and utilities (waterlines, sanitary sewer lines and storm drainage conveyance systems) shall be designed to the specifications set forth in the design criteria and standards of the Public Works Department and be subject to review and approval by the Public Works Department at construction drawing submittal.
 - 2. The designing professional (a NCPE, NCPLS or NCRLA – as required) will submit 3 sets of construction drawings to City Engineering for review and approval before starting

construction (see Construction Plan Approval Process). This submittal must be done prior to applying for a building permit. **NOTE:** The approval of construction drawings is separate from site plan approval.

3. As-built drawings shall be approved prior to water meter and sanitary sewer service connection installations and prior issuance of a certificate of occupancy.
- b. In the special conditions of approval box, add the following notes as required:
 1. **Extension Agreement required (submit after site plan approved but before construction plans).** Contact Engineering Division (560-4326, FAX 560-4316) with complete name (Individual, Inc., Corp., etc) and telephone number of entity extending services to the site.
 2. **Annexation petition required.** Contact Budget Department at 560-4111.
 3. If a hydrant is proposed a fire flow analysis is required. Waterline size may change with fire flow analysis. Contact City Engineering at 560-4326 to schedule flow test or to obtain current system data.
 4. Water and sanitary sewer permits are required for this project.
 5. Back flow permit required with this project. Contact Department of Water Management at 560-4194.
 6. A NCDOT or City of Durham Driveway Permit is required.

Engineering Final Plat Checklist

Date: _____

Project Information

Project Name: _____

Phase: _____ Planning Case #: _____

Previous Project Name/s: _____

PIN numbers: _____

Contact Person: _____ Email Address: _____

Company Name: _____ Phone Number: _____

Instructions

The following is a list of standard final plat requirements that are reviewed by the City of Durham Engineering Division at the final plat stage of Development Review. This list is intended to give general guidelines only and is not to be considered all-inclusive. Depending upon the development additional items may be required. Final Plat Submittals without the following minimum criteria will be returned to the applicant without a complete review being performed thus resulting in additional delays to the final plat process until the information is provided. Initial in the space provided to indicate the following submittal requirements have been met.

Standard Requirements

Initial

- _____ Show all of the following items: Project name, Parcel ID #, PIN, township, date (original and all revisions), North Arrow (labeled with source – PB/PG reference and/or NC Grid datum reference), and vicinity map with North Arrow (only required on Sheet 1) that clearly locates site with readily recognizable street names and landmarks.
- _____ Provide the name, address, telephone number, facsimile number, and email address if applicable of professional with a seal, signature and date.
- _____ Provide a graphic and a numeric scale on each applicable Sheet of the plat (use Standard scales).
- _____ Show the City of Durham Case Number on the plat (provided by the City of Durham Planning Dept.).
- _____ The plat must accurately reflect the data as shown on a currently approved Site Plan or set of Construction Drawings (if applicable) and adhere to all applicable City of Durham Development Standards.

Certificates Required

Initial

- _____ Provide the surveyor's certificate of accuracy and mapping stating that the plat has been prepared in accordance with GS 47-30, as amended.
- _____ Provide the Survey Type Certificate.
- _____ Provide a Review Officer's stamp.
- _____ Provide an Owner's Certificate with a Notary's Certificate for each owner involved
- _____ Provide an Attorney's Certificate with a Notary's Certificate for each owner involved. **(ONLY REQUIRED FOR DEDICATION OF RIGHT-OF-WAY, PUBLIC EASEMENTS, OR OPEN SPACE).**

Standard Notes Required

Initial

- _____ Provide the Standard Driveway Note stating "the minimum driveway length shall be 20' measured from the right-of-way or street easement line as applicable".
- _____ Provide the Standard Townhome Note per the Reference Guide for Development stating, "the driving and parking areas shown on this drawing noted as "Private Access and Common Areas" do not meet City of Durham Street Standards. The features within this area are private and will never be eligible for public maintenance".
- _____ Provide the Standard Sanitary Sewer Easement and/or Waterline Easement Notes (for Public Easements only) as applicable.
- _____ Provide the Standard Stormwater Easement Note for Public and/or Private Easements as applicable.

Graphical Data and Reference Requirements

Initial

- _____ Provide the exact boundary of the property being subdivided/recombined, with sufficient survey data to readily determine and reproduce on the ground every line shown on the boundary.
- _____ Graphically show all new property lines, clearly distinguishable from existing, all lot numbers (lot numbers shall run consecutively), all required setbacks (including Easement Setbacks), typical lot layouts, buffer limit lines, open spaces (defined with numbers or letters), and other common areas. Provide total land area, proposed use, and boundary descriptions for all parcels of land to be designated/dedicated/reserved for public or private use. Provide an "Area Table" showing the areas for each type of parcel (i.e. Lots, R/W, Open Space, etc.) as well as a total area computation.
- _____ When subdividing or recombining property, graphically show all property lines to be removed, clearly distinguishable from property lines to remain. Provide data for all property lines or portions of property lines to be removed and label them as "Hereby Removed".
- _____ Provide bearing, distance, and curve data for all lot and boundary lines. Linear dimensions shall be expressed in feet and decimals of a foot and all angular measurements shall be expressed by bearings.
- _____ All curves shall be defined by radius, central angle (delta), tangent, arc, chord distances, and chord bearings. All curve data shall be shown in Curve Tables.
- _____ All line segments and curves listed in Line Segment and Curve Tables shall be shown in the appropriate locations on the plat, designated by L-# or C-#, and they shall be numbered consecutively throughout all Sheets of the plat. (i.e. do not begin renumbering on each Sheet).
- _____ Graphically show and appropriately label all "Proposed" alley lines, building setbacks, cemeteries, utility, storm drainage, greenway, and other easements. Define all "Proposed" easements with either boundary data or centerline data, and ties to property corners. (This applies to both Public and Private Easements).
- _____ Graphically show and appropriately label all "Existing" alley lines, building lines, cemeteries, utility,

Initial

storm drainage, greenway, and other easements. Define all “Existing” easements with PB/PG and/or DB/PG references and centerline or boundary ties to property corners. If no existing references are available or if the easements have been resurveyed, define them with centerline or boundary data and ties to property corners. (This applies to both Public and Private Easements).

- _____ Graphically show the angle of departure of all adjoining property and right-of-way lines.
- _____ Provide the names of all adjoining property owners with deed and/or plat book references and Pin and Parcel ID numbers. If applicable, provide existing adjoining Lot numbers with the existing subdivision name and references.
- _____ Graphically show all street rights-of-way within or adjoining the property and label them with the street name (and SR Number if applicable), right-of-way width, “Public” or “Private”, and “Existing” or “Hereby Dedicated”. If available, provide the DB and/or PB references for all “Existing” rights-of-way.
- _____ Where available within 2000’, provide a precise tie (with bearing, distance, co-ordinate sets, and appropriate N.C. Grid Datum labels), between one or more prominent points on the exterior boundary of the property and a N.C. Grid Monument. If no monument is available within 2000’, add a note to the plat stating such, and provide bearing and distance ties, along with appropriate PB/PG references to the existing recorded plat used as the source to establish the plat bearings. **N/A FOR EXEMPT PLATS (see planning for requirements of Exempt Plats).**
- _____ Label two or more permanent “Control Corners” on the plat. **N/A FOR EXEMPT PLATS (see planning for requirements of Exempt Plats).**
- _____ Acquire the addresses from the City of Durham for all lots or parcels and show them on the plat.

Additional Requirements for Plats with Multiple Sheets

Initial

- _____ Provide an overall **Index Map** with a North Arrow, Lot Numbers, Street Names, Matchlines, and Sheet Numbers, defining the total area of coverage and indexing the area of coverage for each Sheet of the plat.
- _____ Graphically provide a consecutive Sheet Number for each Sheet of the plat along with the total number of Sheets (i.e. Sheet 1 of __, etc.)
- _____ Graphically show and label “Matchlines” on each Sheet of the plat. Also, provide labels along the Matchlines (i.e. “See Sheet__”) defining all adjoining Sheet Numbers.

SECTION 1.2

STORMWATER SERVICES DIVISION REZONING, SITE PLAN, PRELIMINARY PLAT AND FINAL PLAT SUBMITTAL REQUIREMENTS

The following section provides submittal checklists, which shall be used by the applicant before any rezoning, site plan, preliminary plat or final plat submittals so that the applicants are aware of the minimum requirements in order to receive a complete review. All checklists shall be sealed, dated and signed by a design professional.

The design checklists for rezoning, site plan, preliminary plat and final plat are to be submitted with all submittals, including resubmittals. Failure to submit these checklists and item requirements with each submittal will result in no review of the documents.



City of Durham Public Works – Stormwater Services
101 City Hall Plaza Durham, NC 27701
Phone: (919) 560-4326 Fax: (919) 560-4316

Stormwater Services Division Rezoning Plan Submittal Checklist

Date: _____

Design Professional's Signature and Seal

Project Information

Project Name: _____

Phase: _____ Planning Case #: _____

Previous Project Name/s: _____

PINs: _____

Easting and Northing for the center of the
property, in North Carolina State Plane
coordinates, NAD 83 Feet

Contact Person: _____ Phone Number: _____

Company Name: _____ Fax Number: _____

e-mail: _____

Instructions

For each review submittal, including re-submittals, the submittal checklist and supporting documentation shall be submitted. Partial submittals will **NOT BE REVIEWED** and will be returned with **NO REVIEW PERFORMED**. Note: The rezoning process is conceptual in nature; the approval of proposed stormwater control measure(s) (SCM[s]) will not occur with the Rezoning Plan.

The following checklist outlines submittal requirements. Initial in the space provided to indicate the following submittal requirements have been met and supporting documentation is attached.

Initials

- _____ (Check One) ☐ INSIDE ☐ OUTSIDE Watershed Protection Overlay (WPO).
Indicate the WPO(s) where the project is located:
(Check all that apply) ☐ F/J-A ☐ F/J-B ☐ E-A ☐ E-B ☐ M/LR-A ☐ M/LR-B
- _____ (Check One) ☐ Jordan Lake Basin ☐ Falls Lake Basin ☐ Neuse River Basin
- _____ A legible copy of the United States Geological Survey 7.5 Minute Quadrangle map is provided, including map reference, with site boundary clearly shown and labeled. The map clearly shows all streams.
- _____ A legible copy of the published Durham County Soil Survey is provided, including map reference, with the site boundary clearly shown and labeled. The map clearly shows all streams, soil types, and soil type boundaries.
- _____ Tops of banks for the streams are shown on the plan. [Contact the North Carolina Department of Environment and Natural Resources for stream identifications in the NRB. Stream determinations in the CFRB shall be submitted per our Letter to Industry found on our web site at [New Stream Buffer Requirements \[First Revision to LTI 07-03-08\] \(25August2011\)](#)].
- _____ All Watershed Protection Overlay, Neuse River Basin, and Cape Fear River Basin riparian buffers, measured from the tops of the stream banks, are shown on the plan.
- _____ The 10-foot no build setback, measured from all riparian buffers, is shown on the plan.
- _____ Diffuse flow is achieved at all concentrated discharges into riparian buffers.
- _____ (Check One) ☐ Yes ☐ No Floodplain located on site.
- _____ A legible copy of the effective Federal Emergency Management Agency (FEMA) National Flood Insurance Program Flood Insurance Rate Map is provided, including map number and map date with the site boundary clearly shown and labeled. [This map is required regardless of whether floodplain is located on the site]. The effective and/or future FEMA 100-year floodplain, with base flood elevations (if applicable), if applicable, is shown on the plan.



City of Durham Public Works – Stormwater Services
101 City Hall Plaza Durham, NC 27701
Phone: (919) 560-4326 Fax: (919) 560-4316

Stormwater Services Site Plan and Preliminary Plat Submittal Checklist

Date: _____

Design Professional's Signature and Seal

Project Information

Project Name: _____

Phase: _____ Planning Case #: _____

Previous Project Name/s: _____

PIN numbers: _____

Easting and Northing for the center of the
property, in North Carolina State Plane
coordinates, NAD 83 Feet _____

Contact Person: _____ Phone Number: _____

Company Name: _____ Fax Number: _____

e-mail: _____

Instructions

For each review submittal, including re-submittals, the entire study and submittal checklist shall be submitted. Partial study packages will **NOT BE REVIEWED** and will be returned with **NO REVIEW PERFORMED**.

Contact Stormwater Services regarding redevelopment or expansion projects for modified requirements.

The following checklist outlines submittal requirements. Initial in the space provided to indicate the following submittal requirements have been met and supporting documentation is attached.

A. General Requirements

Initials

_____ (Check One) ☐ INSIDE ☐ OUTSIDE Watershed Protection Overlay (WPO).

Indicate the WPO(s) where the project is located:

(Check all that apply) ☐ F/J-A ☐ F/J-B ☐ E-A ☐ E-B ☐ M/LR-A ☐ M/LR-B

If inside WPO, completion of WPO Standards is required.

_____ (Check One) ☐ Jordan Basin ☐ Falls Basin ☐ Lower Neuse Basin

_____ A legible copy of the United States Geological Survey 7.5 Minute Quadrangle map is provided, including map reference, with site boundary clearly shown and labeled. The map clearly shows all streams.

_____ A legible copy of the published Durham County Soil Survey is provided, including map reference, with the site boundary clearly shown and labeled. The map clearly shows all streams, soil types and soil type boundaries.

Initials

- _____ Tops of bank for the streams are shown on the plan. [Contact the North Carolina Department of Environment and Natural Resources for stream identifications in the NRB. Stream determinations in the CFRB shall be submitted per our Letter to Industry found on our web site at [New Stream Buffer Requirements \[First Revision to LTI 07-03-08\] \(25August2011\)](#)].
- _____ All WPO, NRB and City riparian buffers, measured from the tops of the stream banks, are shown on the plan.
- _____ The 10-foot no build setback, measured from all riparian buffers, is shown on the plan.
- _____ Diffuse flow is achieved at all concentrated discharges into riparian buffers.
- _____ (Check One) ☐ Yes ☐ No Floodplain located on site.
- _____ A legible copy of the effective Federal Emergency Management Agency National Flood Insurance Program Flood Insurance Rate Map is provided, including map number and map date and site boundary clearly shown and labeled. [This map is required regardless of whether floodplain is located on the site.] The effective and/or future FEMA 100-year floodplain, with base flood elevations (if applicable), are shown on the plan.
- _____ All applicable notes, per the Standard Notes section of the RGD, have been added to the plan.
- _____ Stormwater Impact Analysis (SIA) sealed and signed by a registered North Carolina Professional Engineer (NCPE) is provided, including narrative report and drainage calculations.

B. Peak Discharge Rate Evaluation¹

Initials

- _____ An introductory narrative describing pre- and post-development site conditions and site improvement changes, is provided.
- _____ Drainage area maps (one map for pre-development and one map for post-development) are provided with the following items:
 - _____ Scale and north arrow (Note: Except in the instance of site-to-drainage area maps, the scale of each drainage area map shall not exceed 1" = 30').
 - _____ Sub-basin area(s) delineated with area(s) in acres indicated.
 - _____ Analysis points clearly identified and labeled.
 - _____ Segmented TR-55 time of concentration flow paths showing and labeling each segment.
- _____ Methodologies and procedures are fully described.
- _____ A site plan or grading plan identifying pre- and post-development drainage patterns is provided.
- _____ Pre- and post-development times of concentration, calculated by TR-55 segmented approach, are provided.
- _____ Calculations for the pre- and post-development peak discharge rates are provided for the 1-, 2-, 10-, and 100-year, 24-hour storm using TR-55, TR-20, HEC-HMS, HEC-1 or Rational Method as applicable.
- _____ A Summary of Results is provided in the following format:

¹ See Design Summaries and NCDENR BMP Manual (latest edition) for details and SCM design requirements

Site Analysis Point # _____

Site Condition	Storm Event (cfs)				
	1-year (cfs)	2-year (cfs)	10-year (cfs)	100-year (cfs)	____-year (cfs)
Pre-Development					
Post-Development without Detention					
Post-Development with Detention					

- _____ Conclusions providing detailed findings are provided.
- _____ Stormwater control measure(s) (SCM[s]) are provided (indicate number of each type of SCM):
 _____ Constructed Wetland _____ Dry Pond _____ Extended Detention Dry Pond
 _____ Wet Pond _____ Underground Detention
 _____ Bioretention Area (1-year peak discharge rate attenuation only)
 _____ Open Sand Filter (1-year peak discharge rate attenuation only)
 _____ Other _____
 _____ Not required (provide explanation): _____
- _____ The SCM(s) indicated above control the following peak discharge rates:
 _____ 1-year _____ 2-year _____ 10-year _____ 100-year _____ Other _____
- _____ A downstream analysis is provided with findings, or is
 _____ Not required (provide explanation): _____

C. Pollutant Control Requirements

Initials

- _____ The proposed project is _____ $\geq 16\%$ impervious (Falls and Jordan Basins) / _____ $\geq 24\%$ impervious (Lower Neuse Basin), 85% Total Suspended Solids (TSS) removal is provided for this project, and 100% of the impervious area is treated by an SCM.
- _____ The proposed project is _____ $<16\%$ impervious (Falls and Jordan Basins) / _____ $<24\%$ impervious (Lower Neuse Basin), 85% Total Suspended Solids (TSS) removal for all runoff from non vegetated conveyances is provided for this project, and 100% of the impervious area is treated by an SCM.

_____ SCMs for TSS removal are provided (indicate number of each type of SCM):

_____ Bioretention Area _____ Bioretention Area with Internal Water Storage (IWS)

_____ Constructed Wetland _____ Wet Pond

_____ Open Sand Filter _____ Open Sand Filter with IWS

_____ Closed Sand Filter _____ Closed Sand Filter with IWS

_____ Rainwater Harvesting System _____ Green Roof System

_____ Other (specify) _____

_____ Not required (provide explanation):

_____ Both hard copies, and Excel-format electronic copies on a compact disc, of the following:

- Pre- and post-development nutrient calculations using the Jordan/Falls Lake Stormwater Nutrient Load Accounting Tool found at :
<http://portal.ncdenr.org/web/jordanlake/implementation-guidance-archive> or
<http://portal.ncdenr.org/web/wq/ps/nps/fallslake>
- The Nutrient Reporting Form (including the Compliance Worksheet tab) per our 3/7/2013 Letter to Industry <http://durhamnc.gov/ich/op/pwd/storm/Pages/LTI-SWDevReview.aspx>

_____ Pre- and post-development land use maps for the nutrient calculations, to scale no smaller than 1 inch = 100 feet. The maps shall show the map scale, north arrow, and are to have the different land uses either hatched or shaded with areas indicated in a legend on the maps.

_____ SCMs for nutrient control are provided (indicate number of each type of SCM):

_____ Bioretention Area _____ Bioretention Area with Internal Water Storage (IWS)

_____ Constructed Wetland _____ Open Sand Filter _____ Open Sand Filter with IWS

_____ Closed Sand Filter _____ Closed Sand Filter with IWS _____ Green Roof System

_____ Level Spreader (LS) with 50-foot Restored Riparian Buffer _____ Proprietary SCMs

_____ LS with 30-foot Engineered Filter Strip _____ Rainwater Harvesting System

_____ Wet Pond _____ Extended Detention Dry Pond _____ Vegetated Water Quality Swale

_____ Other (specify) _____

_____ Not required (provide explanation):

_____ After meeting the minimum on-site treatment requirements, additional treatment and/or offsite credit purchases, if needed, is provided by:

_____ Additional SCMs

_____ Nutrient Offset Payment to the North Carolina Ecosystem Enhancement Program

_____ Nutrient Offset Payment to an Approved Nutrient Bank

_____ Land Bank Credit Transfer

_____ The project site is located in an area subject to a state-approved Total Maximum Daily Load (TMDL) for bacteria. (As of July 2012, only Northeast Creek has a TMDL for bacteria).

_____ SCMs rated as medium or high for bacterial removal are provided (indicate number of each type of SCM):

_____ Bioretention Area _____ Bioretention Area with Internal Water Storage (IWS)

_____ Constructed Wetland _____ Wet Pond

_____ Open Sand Filter _____ Open Sand Filter with IWS

_____ Closed Sand Filter _____ Closed Sand Filter with IWS

_____ Other (specify) _____

_____ Not required (provide explanation): _____

D. Watershed Protection Overlay Requirements

Initials

_____ 85% Total Suspended Solids (TSS) removal is required for this project, and 100% of the impervious area will be treated by an SCM.

_____ SCM for TSS removal are provided (indicate number of each type of SCM):

_____ Bioretention Area _____ Bioretention Area with Internal Water Storage (IWS)

_____ Constructed Wetland _____ Wet Pond

_____ Open Sand Filter _____ Open Sand Filter with IWS

_____ Closed Sand Filter _____ Closed Sand Filter with IWS

_____ Rainwater Harvesting System _____ Green Roof System

_____ Other (specify) _____

_____ Not required (provide explanation): _____



City of Durham Public Works – Stormwater Services
101 City Hall Plaza Durham, NC 27701
Phone: (919) 560-4326 Fax: (919) 560-4316

Design Professional's Signature and Seal

Stormwater Services Division Final Plat Submittal Checklist

Date: _____

Project Information

Project Name: _____

Phase: _____ Planning Case #: _____

Previous Project Name/s: _____

PINs: _____

Easting and Northing for the center of the
property, in North Carolina State Plane
coordinates, NAD 83 Feet

Contact Person: _____ Phone Number: _____

Company Name: _____ Fax Number: _____

e-mail: _____

Instructions

For each review submittal, including re-submittals, the submittal checklist shall be submitted with the final plat. Submittals that do not include the submittal checklist will **NOT BE REVIEWED**. The following is a list of standard final plat requirements that are reviewed by Stormwater Services Division. This list is intended to give general guidelines only and is not to be considered all-inclusive. Depending upon the development, additional items may be required. Final plat submittals without the following minimum criteria will be returned to the applicant with **NO REVIEW PERFORMED**.

Initial in the space provided to indicate the following submittal requirements have been met and supporting documentation is attached.

Initials

- _____ All stormwater control measure(s) (SCM[s]) easements are shown on the final plat exactly as shown on the approved construction drawings (CDs).
- _____ All SCM(s) access easements are shown on the final plat exactly as shown on the approved construction drawings (CDs).
- _____ The easement note per the Standard Notes section of the Reference Guide for Development (RGD) has been added to the final plat for the SCM easements and the SCM access easements.
- _____ The effective and/or future Federal Emergency Management Agency (FEMA) 100-year floodplain, with base flood elevations (if applicable), is shown on the final plat. The effective FEMA National Flood Insurance Program Flood Insurance Rate map number, map date, and flood zones are indicated on the final plat. [Note that the map number, map date, and flood zones shall be indicated on the final plat even if floodplain is not present on the property.]
- _____ The maximum impervious surface area per lot, as required by the approved site plan and approved stormwater impact analysis, is shown.
- _____ Tops of banks for the streams are shown on the final plat. [Contact the North Carolina Department of Environment and Natural Resources for stream identifications in the Neuse River Basin (NRB). Stream determinations in the Cape Fear River Basin (CFRB) shall be submitted per our Letter to Industry found on our web site at [New Stream Buffer Requirements \[First Revision to LTI 07-03-08\] \(25August2011\)](#)].
- _____ All Watershed Protection Overlay, Neuse River Basin, Cape Fear River Basin, and City riparian buffers, measured from the tops of the stream banks, are shown on the final plat.
- _____ The 10-foot no build setback, measured from all riparian buffers, is shown on the final plat.
- _____ The riparian buffer note per the Durham City-County Planning Department (Planning) has been added to the final plat.

Note: In accordance with the Planning Unified Development Ordinance, Stormwater Services Division reviews final plats for a specific site after the construction drawings for that site have been approved by the City. As such, Stormwater Services Division does not review final plats that are only for rights-of-way dedication and will have no comments on these types of final plats.

SECTION 1.3

DEPARTMENT OF TRANSPORTATION SITE PLAN, PRELIMINARY PLAT AND FINAL PLAT SUBMITTAL REQUIREMENTS

The following section provides a list, which should be used by the applicant before any site plan, preliminary plat or final plat submittals so that the applicants are aware of the minimum requirements in order to receive a complete review. The checklists in this section are intended as a guide and are not a submittal requirement with plans.



City of Durham
Public Works Department
Department of Transportation
101 City Hall Plaza
Durham, North Carolina, 27701
Telephone (919) 560-4366
Fax (919) 560-4561

Transportation Site Plan and Preliminary Plat Submittal Checklist

The following is a list of standard site plan and preliminary plat requirements that are reviewed by the City of Durham Transportation Division at the site plan stage of Development Review. This list is intended to give general guidelines only and is not to be considered all-inclusive. Depending upon the development additional items may be required. Site Plan and Preliminary Plat Submittals without the following minimum criteria will be returned to the applicant without a complete review being performed thus resulting in additional delays to the site plan or preliminary plat process until the information is provided.

I. PROJECT INFORMATION

Project Name: _____ Phase: _____
Previous Project Name, if applicable: _____
PIN: _____ Tax Map Number _____ Planning Case Number: _____
Project Comment Contact Person: _____ Phone number (____) _____
Fax number: (____) _____ Company Name: _____

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines submittal requirements. Initial in the space provided to indicate the following submittal requirements have been met.

A. Access Points

Applicant's initials (typical all sections)

- _____ a. Less than 60 units – one public street access.
- _____ b. 60-90 units – 2 public street accesses or one divided access with no utilities.
- _____ c. More than 90 units or commercial development – 2 public street accesses.
- _____ d. Add a note on the plan regarding the limit of units before another access street is built.
- _____ e. Access points needed for connectivity.

B. Usability of Access Points

- _____ a. Sight distances (horizontal and vertical alignments and obstructions).
- _____ b. Landscaping in right-of-way or interfering with sight distance (sight triangle).
- _____ c. Sight distance triangles for adjacent drives.
- _____ d. Relationship to other streets and drives (300' min. offset on residential streets).
- _____ e. Entrance type (street type allowed if greater than 90 parking spaces).
- _____ f. Driveway grades (10% max.).
- _____ g. Turning radii (particularly fire access).
- _____ h. Turning lanes (left and right turns in and out).

C. Adjoining Property

- _____ a.Dedicated streets (are connections made or needed?).
- _____ b. Land locking (is access to adjoining property needed?).

D. Thoroughfares

- _____ a.Any proposed thoroughfares through the property (right-of-way and construction).
- _____ b. Additional right-of-way needed on streets adjoining project.

E. Street Design

- _____ a.Meets Table of Minimum Design Requirements for Public and Private Residential Streets.
- _____ b. Sight Distance (vertical and horizontal curves, landscaping, signs etc.).
- _____ c.Street grades.
- _____ d. Driveway spacing, width, location and distance from intersection.
- _____ e.Correct street and right-of-way width – according to street type.
- _____ f.Minimum centerline radius – as per design speed.
- _____ g. Maximum cul-de-sac length = 800’.
- _____ h. Minimum cul-de-sac bulb radius = 50’ right-of-way.
- _____ i. Corner right-of-way radius or triangle needed.
- _____ j. Tie into existing strip pave with curb and gutter, curb and gutter to be terminated at proper width.
- _____ k. Widening or construction of streets identified on Urban Bicycle Route Plan must provide 14’ wide outside through lanes.
- _____ l. Is the right-of-way 10 feet behind the back of curb? Is there a dedication of right-of-way?

F. Parking

- _____ a.Parking location and control (maneuvering away from entrances and intersections).
- _____ b. Parking stalls and aisle widths.
- _____ c.Handicapped parking requirement and van accessibility (size and signs) G.S. 20-37.6.
- _____ d. Is a complex source permit required?

G. Miscellaneous

- _____ a.Dumpster location and access (turning radii).
- _____ b. Fire access to all units and/or fire lanes for shopping centers and special occupancies.
- _____ c.Pedestrian access (internal and external sidewalks).
- _____ d. Off-site improvements needed (signals, street widening, turn lanes at intersections, etc.).
- _____ e.Traffic Impact Analysis required if peak hour generation > 150 trips.
- _____ f.Name and dimension cross-sections and right-of-way.
- _____ g. Dumpster pad size.
- _____ h. General notes.



City of Durham
Public Works Department
Department of Transportation
101 City Hall Plaza
Durham, North Carolina, 27701
Telephone (919) 560-4366
Fax (919) 560-4561

Transportation Final Plat Submittal Checklist

The following is a list of standard site plan requirements that are reviewed by the City of Durham Transportation Division at the Final Plat Stage of Development Review. This list is intended to give general guidelines only and is not to be considered all-inclusive. Depending upon the development additional items may be required. Final Plat Submittals without the following minimum criteria will be returned to the applicant without a complete review being performed thus resulting in additional delays to the final plat process until the information is provided.

I. PROJECT INFORMATION

Project Name: _____ Phase: _____
Previous Project Name, if applicable: _____
PIN: _____ Tax Map Number _____ Planning Case Number: _____
Project Comment Contact Person: _____ Phone number () _____
Fax number: () _____ Company Name: _____

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines submittal requirements. Initial in the space provided to indicate the following submittal requirements have been met.

Applicant's initials (typical all sections)

- _____ a. Show required right-of-way and right-of-way dedication (from site plan).
_____ b. Make sure that the plat does not create any land locked parcels.
_____ c. Make sure that the street names on the plat agree with the street naming convention of the City and County of Durham.

SECTION 2.0

PUBLIC WORKS DEPARTMENT **ENGINEERING AND STORMWATER SERVICES DIVISIONS AND** **DEPARTMENT OF TRANSPORTATION AND THE** **CONSTRUCTION DRAWING PROCESS**

The following information is to provide a basic overview of the roles of the above divisions as they relate to the construction drawing review process. However it should be noted that **all plan and calculation submittals shall always** be directed to the City of Durham Engineering Division for distribution to the appropriate Division. Status inquiries and correspondences associated with these processes can be directed to the individual reviewer of each Division.

ENGINEERING DIVISION:

The City of Durham Engineering Division is located on the 3rd floor of City Hall. The Development Review Group is the main contact in the Engineering Division for all Engineering comments that are returned on construction drawings. The Development Review Group can be contacted by mail at the following address: Public Works Department, City of Durham, 101 City Hall Plaza, 3rd Floor, Development Review Group, Durham, North Carolina, 27701. The contact phone number for questions is (919) 560-4326 and fax number is (919) 560-4316.

The City of Durham Engineering Division is tasked with reviewing construction documents as these items relate to the City of Durham public and private road standards, driveways, sidewalks, water systems, fire protection systems, sanitary sewer systems, stormwater drainage and conveyance systems and easements for these systems.

The City of Durham Engineering Division is tasked with distribution of all incoming construction drawings, including resubmittals, and design calculation to the Stormwater Services and Transportation Divisions.

The typical time line for review of construction drawings is approximately 10 business days from the day of receipt of the documents by the City of Durham Engineering Division. The typical time line for review of all resubmittals is approximately 10 business days from the day of receipt of the documents by the City of Durham Engineering Division.

STORMWATER SERVICES DIVISION:

The City of Durham Stormwater Services Division is located on the 3rd floor of City Hall. The Stormwater Services Division is the contact in the Public Works Department for all stormwater analysis comments that are returned on construction drawings. The Stormwater Services Division can be contacted by mail at the following address: Public Works Department, City of Durham, 101 City Hall Plaza, 3rd Floor, Stormwater Services Division, Durham, North Carolina, 27701. The contact phone number for questions is (919) 560-4326 and fax number is (919) 560-4316.

The City of Durham Stormwater Services Division is tasked with reviewing construction drawing documents as these items relate to stormwater impact studies, stream buffers, floodplain analysis, stormwater quality systems and stormwater quantity facilities, as well as major stream crossing systems.

The typical time line for review of construction drawings is approximately 10 business days from the day of receipt of the documents from the City of Durham Engineering Division. The typical time line for review of all resubmittals is approximately 10 business days from the day of receipt of the documents from the City of Durham Engineering Division.

DEPARTMENT OF TRANSPORTATION:

The City of Durham Transportation Division is tasked with reviewing construction documents as they pertain to traffic control devices, signs, pavement markings, lane widths, design and traffic control of roundabouts and placement and design of traffic calming measures. The Transportation Division can be contacted by mail at the following address: Public Works Department, City of Durham, 101 City Hall Plaza, 4th Floor, Transportation Division, Durham, North Carolina, 27701. The contact phone number for questions is (919) 560-4366 and fax number is (919) 560-4561.

The typical time line for review of construction drawings is approximately 10 business days from the day of receipt of the documents from the City of Durham Engineering Division. The typical time line for review of all resubmittals is approximately 10 business days from the day of receipt of the documents from the City of Durham Engineering Division.

What Types of Plans Need to be Submitted for Construction Plan Approval

This section is intended to notify the Engineer and the Developer of those plans that need to be submitted to the City Engineering Division for Construction Plan review and approval before construction can begin. Note: Construction plan approval process begins after Zoning and Site Plan approval.

General

Confirm that the site plan has valid approval. This generally will be a plan indicating the improvements, which will have the Planning Department's Site Plan Approval Stamp. Be aware that some plans may have expiration dates. If there is any question about the validity of the plan contact the City/County Planning Department.

<u>Type of Development</u>	<u>Construction Plan Required</u>	<u>Refer to Section</u>
Commercial/Institutional/Educational		
Only if any items are listed as 'Yes' in <u>Specific Improvements</u> below	Yes	2.0-2.5
Multifamily	Yes	2.0-2.5
Subdivision	Yes	2.0-2.5

<u>Specific Improvements</u>	<u>Construction Plan Required</u>	<u>Refer to Section</u>
<i>Water Supply</i>		
Service (lateral)	No	<u>Building Inspections</u>
Water main extension	Yes	5.0
Fire Line	Yes	6.0
Backflow Prevention (BFP outside of buildings)	Yes	6.0
Hydrant Installation	Yes	5.0

Sanitary Sewer System

Service (lateral)		
4-inch line (1 building)	No	<u>Building Inspections</u>

<u>Type of Development</u>	<u>Construction Plan Required</u>	<u>Refer to Section</u>
4-inch line (2 or more buildings)	Yes	7.0
6-inch line that services only 1 building w/out 4 hour fire walls	No	<u>Building Inspections</u>
All others	Yes	7.0
Extensions		
Mains (Any pipe 6-inches or greater)	Yes	7.0
Outfalls	Yes	7.0
Pump Stations/force mains	Yes	7.0
Industrial	Yes	<u>Water Management</u>
See Service or Extension (above)		As required
<u>Specific Improvements</u>	<u>Construction Plan Required</u>	<u>Refer to Section</u>
<i>Storm Drainage System</i>		
Pipe in right-of-way	Yes	8.0
Any pipe or conveyance of 15-inch equivalent diameter or larger	Yes	8.0
Water Quality/Quantity Basins	Yes**	8.0-8.4
Crossing public easements	Yes	8.0
On-site drainage	Yes	8.0
<i>Streets (public or private)</i>	Yes	9.0
<i>Driveway</i>		
Commercial		
With approved site plan	No*	
Site plan not required	Yes*	9.0
Residential-multifamily		
With approved site plan	No*	

<u>Type of Development</u>	<u>Construction Plan Required</u>	<u>Refer to Section</u>
Site Plan not required	Yes*	9.0
Single Family		
Existing street	No*	
Site Plan not required	Yes*	9.0
<i>Sidewalk</i>		
With approved site plan	No*	
Without site plan	Yes*	11.0

* Permit required from the City of Durham Engineering Division and/or from NCDOT.

** Permit fee, surety and executed Stormwater Facility Agreement and Covenant required by direction of the Stormwater Service Division.

SECTION 2.1

CONSTRUCTION DRAWING APPROVAL PROCESS

This section is intended to aid in the process of construction plan submittal.

I. Before Submitting Construction Plans

1. A valid, DRB approved site plan with the DRB date of approval written in the Planning Department approval box shall be obtained before submitting construction drawings. If there are any questions contact the City/County Planning Department at (919) 560-4137.
2. A single construction drawing review will be granted after DRB approval but before the site plan is actually approved, which is indicated by the Planning Department's Approval Stamp and Signature. After the first review of construction drawings, a signed and stamped site plan must be obtained from the Planning Department before a second construction drawing review is granted or before construction drawings can be approved. Be aware that some plans may have expiration dates. If there are any questions contact the City/County Planning Department at (919) 560-4137.
3. Some projects require additional approvals that are beyond local authority (for example: erosion control permits, wetland permits, etc.). The Durham City Engineering Division requires that all appropriate agencies be contacted and approvals for the plans shall be obtained. Even if the City Engineering Division does not ask for proof of approvals, it does not relieve the applicant from obtaining them.
4. If water and/or sanitary sewer lines are extended outside the City Limits, an Extension Agreement Application shall be submitted to the City Engineering Division. In addition, an Annexation Petition Package shall be submitted to the City of Durham Budget and Management Services (919) 560-4111. The Extension Agreement will be prepared by Engineering Division and submitted to the owner for signatures. A fully executed (completed with signatures and approval by City Council) Extension Agreement is required prior to Construction Drawing Approval outside the City Limits. If the site is located within the City Limits the Engineering Division may require an Extension Agreement Application to be submitted. If the Extension Agreement application is required the completed Extension agreement with signatures must be submitted to Engineering before construction drawing approval. A copy of the Extension Agreement Application and description of the process is located in Section 13.0, Forms.
5. Developers shall engage the services of a Professional Engineer registered in the State of North Carolina (NCPE) to prepare, sign and seal plans and specifications for the construction of all streets, water, sanitary sewer and applicable storm drainage systems and structures (Developers may also engage the services of a registered Professional Land Surveyor or Landscape Architect registered in the State of North Carolina to prepare, sign, seal plans and specifications for the construction of streets and applicable storm drainage systems and structures). For more detailed requirements of these construction plans see also the Sections 2.3, Construction Phase, through Section 12.0, Standard Notes.
6. Sanitary sewer pump stations for projects will require coordination with the City Engineering Division prior to submittal of site plan or construction plans. This is to determine if the station is feasible and to determine the design parameters that apply.

II. Construction Plan Approval Process

1. The construction drawings for each Division of the Public Works Department shall be submitted to the City of Durham Engineering Division as required by the Construction Plan Submittal Requirements (see Section 2.3, Construction Phase). The City of Durham will review the submittals for completeness by the end of the second business day after receipt of submittal. If all of the required items for each Division are not included in the submittal, the entire submittal set will be rejected. The contact person listed on the submittal form will be notified and told to pick up the rejected submittal with a redlined list of the missing items. All accepted submittals will be distributed to each Division for review. When the reviews are completed the project contact person will be notified that any comments are available for pickup at the City of Durham Engineering Division located on the 3rd floor of City Hall. Included with the comments (either in letter format or redlined on cover sheet) will be instructions to the consultants as to the next step in the construction plan submittal process.
2. When plans have completed the entire review cycle, the consultant will be instructed to provide all stormwater fees, surety and maintenance agreements (if applicable – see note below) and to submit original drawings (reproducibles) for final review, sealing and signoff by the Engineering, Stormwater Services and Transportation Divisions (*see sample of stamp at the end of this section*).

Note: Permit fee, surety and executed maintenance agreements for stormwater quality and/or quantity best management practices are required per the Stormwater Services Division. No plans will be allowed to proceed with construction until all of these items are completed.

The approval stamp below shall be provided on all of the construction drawing sheets by the design professional.

CITY OF DURHAM
PUBLIC WORKS DEPARTMENT
APPROVED

ENGINEERING	_____	DATE	_____
STORM WATER	_____	DATE	_____
TRANSPORTATION	_____	DATE	_____
	_____	DATE	_____
	_____	DATE	_____

III. Construction Plan Permitting Process

After construction plans are approved and signed by all applicable Divisions of the Public Works Department, the applicant will receive signed reproducibles and a City of Durham Transmittal Letter (see end of this section). The transmittal letter will indicate what permit forms are required, the number of approved construction document copies that are needed and permit fees that are required for the project.

The applicant is required to resubmit the required number of permit forms, fees and approved, signed construction documents copies to the City of Durham Engineering Division and/or the State of North Carolina as directed by the City of Durham Transmittal. The City will review the permit applications for accuracy and compliance with all requirements. The review takes approximately 10 business days. All City of Durham approved permit applications are issued at the end of the review period. **CITY OF DURHAM PERMITS ARE NOT IMMEDIATELY ISSUED AFTER SUBMITTAL OF PERMIT APPLICATIONS.** Permit applications, which require State of North Carolina approval or North Carolina Department of Transportation approval, require substantial additional review by those agencies and the City of Durham does not issue these permits and is not responsible for delays in acquiring these permits.

Typical permits which are submitted and/or issued by the City of Durham include public/private water mains (permitted by City of Durham), public/private sanitary sewer mains (permitted by City of Durham and/or the State of North Carolina) and public sanitary sewer pump stations (submitted by City of Durham to the State of North Carolina and issued by the State of North Carolina). NCDOT utility and sidewalk encroachment agreements (submitted by City of Durham to NCDOT) are issued by NCDOT.

Please note that a variety of permitting situations apply for sanitary sewer inside Durham County and the City of Durham and that the applicant shall pay special attention to these situations and to the City of Durham Transmittal letter. Certain situations will require that the applicant submit plans for review and/or permitting to the State of North Carolina through *Durham County Engineering* or directly to the State of North Carolina. These situations often involve longer review periods before permits are issued by those review agencies.

See also Section 3.0, Permitting



Letter of Transmittal

Date: _____

To: _____

From: _____

Re: _____

Extension Agreement: ☐ Approved ☐ Required
 Annexation Petition: ☐ Valid ☐ Not valid

For official use only

Other Submittals

We are returning to you the original reproducible plans for the above mentioned project. These plans have been approved and signed by the City of Durham Public Works Department. Complete the items marked below. Allow a minimum of two weeks after submittal for the processing of any items listed below.

- ☒ Complete the Project Information sheet and submit with **4 sets** of plans. Engineering inspection and frontage fees will be assessed and are to be paid before starting construction.
- ☒ Please include a compact disc with a PDF of the approved Construction Drawings and all approved calculations with the following requirements:
 - Scan resolution of 200 DPI
 - B&W Scan (no color)
 - Multiple Page Scan (no single page)
 - Disc should have project name and case number on the label
- ☒ Contact City of Durham Engineering Inspections at (919-560-4326) 48 hours prior to having a preconstruction meeting. The contractor must have the latest edition of permitted drawings at this meeting.
- ☒ At completion of project, prior to issuance of any certificates of occupancy or compliance, submit **3 sets** of as-built drawings, showing inverts of all manholes and inlets, line sizes and slopes and the location of all meters, fire hydrants, valves, clean-outs, storm drainage, BMPs, etc. Engineering or Stormwater Services inspections may have other items required for as-builts. See Section 4.0, As-built Drawings, through Section 4.6, Underground Detention As-built Drawings, of Reference Guide for Development.
- ☐ Complete a City of Durham Gravity Sanitary Sewer Extension Permit Application and submit **2 sets** of plans and a **\$450 check made payable to City of Durham**. If applicable, submit separate co-applications for public sanitary sewer and private sanitary sewer. Approved sanitary sewer permits are required before starting sanitary sewer construction.
- ☐ Complete the NCDENR application, listing the City of Durham as applicant and submit with **1 set** of plans and a **\$480 check made payable to NCDENR**. Approved sanitary sewer permits are required before starting sanitary sewer construction (County drainage basin, inside city limits, Public).
- ☐ Complete the NCDENR application, listing the Developer as applicant and submit with **1 set** of plans and a **\$480 check made payable to NCDENR**. Approved sanitary sewer permits are required before starting sanitary sewer construction (County drainage basin, inside city limits, Private).
- ☐ The project is within the County jurisdiction. Obtain a sanitary sewer permit from NCDENR and coordinate with Durham County (919) 560-0735 to obtain acceptance letter. Approved sanitary sewer permits are required before starting sanitary sewer construction.

- ☐ This project contains a pump station and force main. Complete the NCDENR application, listing City of Durham/Developer (Public/Private) as applicant, and submit with **2 sets** of plans and a **\$480 check made payable to NCDENR**. Approved pump station permits are required before starting construction.
- ☐ Complete a City of Durham Water Extension Permit Application and submit **3 sets** of plans and **\$450 check made payable to City of Durham**. Approved water permits are required before starting water main construction.
- ☐ Submit 1 copy of plans showing a signage and pavement markings.
- ☐ Submit **6 folded** sets of the sheet(s) that have the sanitary sewer and/or water main improvements shown, within NCDOT right-of-way, for an encroachment agreement. Submit 1 **original** of NCDOT's 16.6 (3-party) form, with the owner's signature as the 2nd party. NCDOT encroachment agreements are required before working within NCDOT right-of-way.
- ☐ Stormwater control facility(ies) (BMP(s)) are required for this project. Provide the required permit fee(s), surety(ies) and executed Stormwater Facility Agreement and Covenant document(s). The required items above are to be completed prior to issuance of any water or sanitary sewer permits or prior to construction of any improvements.
- ☐ Backflow Preventer/s are required on this project. Owner/developer must obtain a Backflow Preventer Permit prior to Water and/or Sewer Extension Permits being issued. Submit the backflow permit application and fee with this submittal. Contact the Cross-Connection Control office at 919-560-4194 to obtain additional information and installation requirements. The City of Durham's backflow permit fee is \$50 per backflow.
- ☐ Other items are as follows:

Other permits may be required for this project (erosion control, NCDOT driveway, etc.). These permits and the items listed above must be obtained/complied with before starting construction or the project may be stopped during construction until these items have been addressed.

Downloadable forms can be found for most of the above referenced items on the City of Durham Public Works Department's website (<http://www.durhamnc.gov/departments/works/handbook/forms.cfm>).

SECTION 2.2

CONSTRUCTION DRAWING SUBMITTAL REQUIREMENTS

The following introduction is used to describe the construction drawing submittal procedure developed to decrease the number of submittals required to obtain construction drawing approval. This procedure was designed and implemented due to concerns in the development community that plan submittals were taking a significant amount of time to be approved and returned so that the permitting could be completed and the construction process could begin.

The consultant shall prepare constructions drawings in accordance with the approved site plan and the City of Durham Reference Guide for Development. The consultant shall then provide a construction drawing submittal package to the City of Durham Engineering Division located at 101 City Hall Plaza, 3rd Floor, Durham, NC 27701. A construction drawing submittal package shall contain the following items:

- A completed original of the City of Durham *Public Works Construction Drawing Submittal Checklist* and shall include all items indicated in the checklist as required for the Engineering Division. All items for the Engineering Division shall be bound together.
- A completed copy of the City of Durham *Public Works Division Construction Drawing Submittal Checklist* and shall include all items indicated in the checklist as required for the Stormwater Services Division. All items for the Stormwater Services Division shall be bound together.
- A completed copy of the City of Durham *Public Works Division Construction Drawing Submittal Checklist* and shall include all items indicated in the checklist as required for the Transportation Division. All items for the Transportation Division shall be bound together.

All submittals will be reviewed for completeness by the end of the second business day after receipt. ***Incomplete submittals for any Division will cause the entire submittal to be rejected from the review process.*** Rejected submittals can be resubmitted for a completeness review the next business day, provided the missing information has been added to the submittal.

Responses to construction drawing comments directly on the redlined plans or in letter format are encouraged.

Construction Drawing Submittal Checklist

Date: _____

Project Information

Project Name: _____

Phase: _____ Planning Case Number: _____

Previous Project Name/s: _____

PIN numbers: _____

Applicant Information

Contact Person: _____

Company Name: _____

Email Address: _____

Phone Number: _____ Fax: _____

Type of Submittal

☐ 1st Construction Drawing Submittal

Fee: ☐ \$500 ☐ \$1,200 (for plans with plan and profile sheets)

☐ Construction Drawing Re-submittal: _____ # of review

☐ Original/Reproducible Construction Drawing Submittal for signatures

☐ Other: _____

Comments:

Instructions

Initial in the space provided to indicate the following submittal requirements have been met. For items that do not apply, the applicant should note "N/A" for those items. Depending upon the project, additional items may be required. Construction drawing submittals without the following minimum criteria will be returned to the applicant **without a review being performed**. All report covers must contain the project name and PIN#s.

Engineering Division Submittal Package Requirements

Initial

- _____ Construction Drawing Submittal Checklist (complete this entire form)
- _____ Utility extension agreement application (if required by Public Works)
- _____ DRB approved site plan (may write the DRB approval date on the cover sheet for the first review; subsequent reviews require site plan copy with Planning approval stamp on the cover sheet)
- _____ Set of Construction Drawings (24"x36" sheet size – to scale)
- _____ Drainage system calculations (HGL calculations for pipes, permanent swales with shear stress calculations and drainage maps)
- _____ Gutter spread calculations (as required by the Reference Guide for Development)
- _____ Culvert calculations (as required by the Reference Guide for Development)
- _____ Fire flow analysis for each individual phase and full project build-out if applicable (as required by the Reference Guide for Development)
- _____ Private/public pump station design calculations and plans
- _____ Redlined Construction Drawings from previous submittal
- _____ Redlined drainage system calculations
- _____ Redlined gutter spread calculations
- _____ Redlined culvert calculations
- _____ Redlined fire flow analysis

Original Submittal

- _____ Original signed/sealed reproducible Construction Drawings for signature
- _____ Original signed/sealed drainage system calculations
- _____ Original signed/sealed gutter spread calculations
- _____ Original signed/sealed culvert calculations
- _____ Original signed/sealed fire flow analysis
- _____ Additional set of Construction Drawings if there are comments from the previous review.

Initial

- _____ Construction Drawing Submittal Checklist
- _____ DRB approved site plan (may write the DRB approval date on the cover sheet for the first review; subsequent reviews require site plan copy with Planning's approval stamp on the cover sheet)
- _____ Approved stormwater impact analysis. If any changes have been made to the site plan that affect the analysis, a revised analysis must be submitted and a revised site plan may be required. Additional time may be required to review the revised analysis.
- _____ Set of Construction Drawings (24"x36" sheet size – to scale)
- _____ Drainage system calculations (HGL calculations for pipes, permanent swales with shear stress calculations and drainage maps)
- _____ Gutter spread calculations (as required by the Reference Guide for Development)
- _____ Culvert calculations (as required by the Reference Guide for Development)
- _____ Final design calculations for any stormwater BMPs. All BMP designs, where routing is a key component of the design, will require the use of storage indication routing methodology such as TR-20 or HEC-1 models. Provide stage-storage relationship and inflow and outflow hydrographs for all routing calculations. Provide all tabulated data, including calculations showing the outlet under orifice control, barrel control, and weir control (as appropriate), and provide the equations used to develop the rating tables/curves.
- _____ Stormwater BMP Design Summary filled out with design calculations (one for each BMP)
- _____ Redlined Construction Drawings from previous submittal
- _____ Redlined drainage system calculations
- _____ Redlined gutter spread calculations
- _____ Redlined culvert calculations
- _____ Redlined final impact analysis
- _____ Redlined stormwater BMP design summary and calculations

Original Submittal

- _____ Original signed/sealed drainage system calculations
- _____ Original signed/sealed gutter spread calculations
- _____ Original signed/sealed culvert calculations
- _____ Original signed/sealed final impact analysis
- _____ Original signed/sealed BMP design summary and calculations
- _____ Additional set of Construction Drawings if there are comments from the previous review.

Initial

- _____ Construction Drawing Submittal Checklist
- _____ DRB approved site plan (may write the DRB approval date on the cover sheet for the first review; subsequent reviews require site plan copy with Planning's approval stamp on the cover sheet)
- _____ Set of Construction Drawings (24"x36" sheet size – to scale)
- _____ Cover sheet with special conditions of approval requirements
- _____ All road widening drawings (public, private or NCDOT)
- _____ Signing and marking drawings
- _____ Signing and marking notes included on plans
- _____ Standard signing and marking details included on plans (sign details, pavement marking details, street marker details, etc.)
- _____ Redlined signing and marking drawings
- _____ Redlined road widening drawings

SECTION 2.3

CONSTRUCTION PHASE

I. Starting Construction

Construction shall not begin until:

1. Construction drawings have been approved, sealed (see *stamp at end of this section) and signed.
2. Proper permits and/or encroachments have been obtained.
 - a. Acquire and dedicate right-of-way
 - b. Acquire and dedicate easements
3. Permit fee, sureties and maintenance agreements for any stormwater control facility (BMP) have been provided to the Stormwater Services Division.
4. Verify that all fees have been paid.
 - a. These fees are mailed if there is/are water mains (permit), sanitary sewer mains (permit) or streets to be constructed with the project.
 - b. Other projects that require Construction Drawing Approval will require an inspection fee to be applied for and paid for at City Engineering.
5. Contact Durham Engineering Inspections for a pre-construction conference no less than 48 hours before starting construction.
6. Provide a Project Construction Information Sheet (See Section).

II. During Construction

During construction of a project, the following shall be kept on site at all times:

1. A set of approved construction drawings and all revisions.
2. A copy of all permits, including water, sanitary sewer, driveway and sediment and erosion control.
3. A set of drawings showing as-built locations of valves, manholes, catch basins, meters, clean-outs, storm drain pipes, culverts, etc.

III. Completing Construction (Closing Construction Plan Process)

After all construction is complete the project is not closed until the following items are completed:

1. The project is complete and is acceptable to the City Engineering Inspection Section.
2. If the following items apply to the approved construction drawings or site plan, they shall be completed prior to the provision of a certificate of compliance or occupancy:
 - o The Developer shall furnish the Engineering Division approved as-built drawings as described in Section 4.0, As-built Drawings. If a right-of-way map is required for public water, sanitary sewer and stormwater easements, the developer shall provide a mylar copy of the right-of-way map. NOTE THAT NO METERS OR SANITARY SEWER SERVICE CONNECTIONS SHALL BE MADE PRIOR TO ACCEPTANCE OF ASBUILTS
 - o The Developer shall furnish the Stormwater Services Division approved as-built drawings as described for any stormwater best management practice described in Section 4.1, Wet Detention Facility As-Built Drawings, 4.2, Sand Filter As-Built Drawings, 4.3, Dry Detention Facility As-Built Drawings, 4.4, Bio-Retention Area As-Built Drawings, 4.5, Constructed Wetlands As-Built Drawings, and 4.6, Underground Detention As-Built Drawings.

- The Engineer shall submit certification pursuant to State water and sanitary sewer permits and stormwater best management practice(s)
 - Complete sidewalk and have it inspected
 - Final right-of-way and driveway inspection approved
 - Complete turn lanes if applicable
 - Complete stormwater collection system and complete stormwater BMP(s) and receive approval of construction
 - Complete water and sanitary sewer, streets and accepted
 - Complete roadway construction, including acceptance, except the top 1-inch of I-2 asphalt. This 1-inch course shall be installed between 6 and 12 months after initial 1 ½-inch course. At the discretion of the City of Durham, posting a bond will be required for this 1-inch course.
 - Utility mainline construction permits for each utility installed
 - The responsible party for each pavement cut identified
3. The Developer shall provide a 1-year warranty on the improvements from date of acceptance (a letter of acceptance will be issued by the City of Durham Public Works Department).

***Approval Stamp that shall appear on the original Construction Drawings provided by the design professional for sign-off:**

CITY OF DURHAM
PUBLIC WORKS DEPARTMENT
APPROVED

ENGINEERING	_____	DATE	_____
STORM WATER	_____	DATE	_____
TRANSPORTATION	_____	DATE	_____
	_____	DATE	_____
	_____	DATE	_____

Approval Stamp in PDF format - Acrobat Reader required.

SECTION 2.4

CONSTRUCTION DRAWING PLAN CHECKLIST

A registered Professional Engineer with the State of North Carolina shall prepare the plans (signed and sealed) for improvements to the water mains, sanitary sewer lines, street improvements and storm drainage systems and structures (see also Sections 2.5, Construction Drawing Profile Checklist, 5.0, Water Supply/Distribution, 7.0, Sanitary Sewer System, 8.0, Stormwater Design Criteria, 8.1, Peak Runoff Rate Increases, 8.2, Neuse River Basin Performance Standards, 8.3, Stormwater Control Facilities (BMPs), and 8.4, Stormwater BMP Design Summaries, and 9.0, Streets. A registered Professional Land Surveyor or Landscape Architect with the State of North Carolina may also be used to prepare street improvements and storm drainage systems and structures. *The following is intended as a guide in the preparation and submitting of plans for public and private improvements for water lines, sanitary sewer lines, street construction and storm drainage systems and structure improvements.*

The City Engineering Division's position is one of review and not of detailed checking. Plans found deficient will result in the rejection of the plans and could delay the entire approval process. Note that plan and profile shall be shown on the same sheet and shall be shown in the same direction.

I. General for All Improvements

- ___ Sheet size to be only 24-inch by 36-inch.
- ___ Plan and profile sheets are required (see also Section 2.5, Construction Drawing Profile Checklist).
- ___ North arrow.
- ___ Parcel Identification Number (PIN) written in the upper right corner.
- ___ A clear vicinity map (shown on the cover sheet or in the upper right corner) clearly showing location of site with respect to existing streets.
- ___ Site map (showing overall limits of improvements on the coversheet or in the upper right corner).
- ___ Bench mark shown and described on each plan and profile page. All elevations to be true and not assumed.
- ___ Cover sheet with all consultants and developers, telephone number, address and email address, project name (any former names), Planning Department's case number and entire special conditions of approval.
- ___ All consultant seals and signatures.
- ___ Does tree protection fence exactly match the site plan tree protection fence? (If not, contact the Planning Department as a revised site plan may be necessary).
- ___ Title block with street or project title, numeric and graphic scale, original date, revision date(s), drawing number, checked by, drawn by all in the lower right hand corner (see typical plan and profile drawing at the end of this section).
- ___ Approval stamp provided on the construction drawings by the design professional (see Section 13.0, Forms, for the Public Works Department stamp) on right side of sheet.
- ___ Note indicating that:
City of Durham standards and specifications are to be used.
- ___ Clearing limits shown.
Note: If the clearing limits are different than what was approved on the site plan, the revised plan shall be signed off by the Planning Department. This could require that the plan go through the entire Development Review Board (DRB)/Planning Department review cycle.
- ___ Adjacent owner(s) showing:

- ___ Names (optional).
- ___ Property lines.
- ___ Addresses (optional).
- ___ Tax map numbers.
- ___ Parcel Identification numbers.
- ___ Right-of-Way widths.
- ___ Existing and proposed with dimensions.
- ___ Easements, existing and proposed with dimensions.
- ___ Reference of plat book and page for dedication of additional right-of-way (if available).
- ___ Existing iron pins from location survey (optional).
- ___ If on a NCDOT road:
 - ___ Reference state road number and street name.
 - ___ Reference centerline intersection distance to nearest state road cross street.
- ___ Beginning and ending stations, including matchline stations for multiple sheets.
- ___ Easement Notes (see also section on Section 12.0, Standard Notes).
- ___ Legend for drawing symbols.
- ___ Drawing symbols to be proportionate.
- ___ Existing paved roads are to be bored for water and sanitary sewer crossings. Show /label and dimension encasement pipe and carrier pipe.
- ___ Show all guardrails (include detail). Use standard NCDOT guardrail.
- ___ Provide standard utility crossing note on the overall utility plan (See Section 12.0, Standard Notes).

II. Water Mains

- ___ Existing/proposed water lines shown (sizes, material) and labeled.
- ___ Dimension and show proposed water main from centerline or right-of-way.
- ___ Proposed water services installed at right angle to street.
- ___ Specify the size of blow-off assemblies.

III. Sanitary Sewer Mains

- ___ Existing/proposed sanitary sewer lines shown and labeled.
- ___ Show angle alignment on outfalls.
- ___ Dimension proposed manhole from centerline.
- ___ Station manholes from left to right.
- ___ For outfalls orient the layout so that the lowest elevation manhole is on the left.
- ___ Manholes: station and label.
- ___ Existing manholes with proposed sanitary sewer connections show the following note: Core drill and install flexible rubber boot.
- ___ Label the manholes as a drop connection or doghouse as appropriate.
- ___ Show stub-out or knock out for future sewer. Stub outs require a minimum sanitary sewer line length of 5-feet (and cap) from the manhole for future sanitary sewer or as directed by the City Engineering Division.
- ___ Lateral cleanouts shall be located at the easement or right-of-way line.
- ___ 4-inch lines should tie into the sanitary sewer main with a tap (avoid the manhole) except at cul-de-sacs or as approved by the City Engineering Division.

- ___ 6-inch lines and larger must tie into a manhole.
- ___ Show sanitary sewer services installed at right angles to the street/sanitary sewer easement for all lots and buildings.
- ___ No storm structures or conveyance systems are shown in sanitary sewer easements except as crossing at 90 degrees.
- ___ Minimum sanitary sewer easement width for sanitary sewer mains is 30-feet. No combined easements are allowed. Overlapping easements are allowed, so long as any structures or conveyance systems are located outside of the sanitary sewer easement and all easements are labeled separately.

IV. Storm Drainage

- ___ An overall grading and drainage plan provided showing existing and proposed grading.
- ___ Storm drainage calculations with hydraulic grade lines and supporting documentation (does not need to be on drawings). See also Section 8.0, Stormwater Design Criteria.
- ___ Signed and sealed by a registered Professional Engineer if system intercepts stormwater from public streets or offsite drainage.
- ___ Show all on-site and adjacent storm drainage facilities.
- ___ Existing drainage shown and labeled including pipes, culverts, manholes, catch basins, ditches, headwalls, endwalls, etc. and appropriate sizes and inverts.
- ___ Proposed drainage system shown and labeled (numbered) on overall grading and drainage plan.
- ___ Proposed storm drainage table showing sizes, inverts, grades, lengths, rims, materials, etc.
- ___ Outlet and inlet protection (type, size/dimensions, material, etc.).
- ___ Channel detail with size, typical section, lining, etc. (on the construction drawing).
- ___ Show and label all storm drainage easements.
- ___ Floodplain data (fringe line, elevation, floodway, and FEMA panel number).
- ___ Delineated wetlands.
- ___ Existing bodies of water (lakes, streams, creeks, etc.) with stream buffers and note (see Section 12.0, Standard Notes).
- ___ Show erosion control sediment basin locations. Basins not to be located on or cause stormwater to be retained on sanitary sewer easement or public right-of-way.
- ___ For public streets with 24-inch pipe or larger include a 4-foot high PVC coated dark green chain link fence at the right-of-way. Length shall be extended to end of fill section as it intersects existing grade.
- ___ Flared end sections or headwalls are required at beginning and end of all stormwater pipes.
- ___ Headwalls and endwalls or flared end sections are required on all pipes, however Stormwater Services reserves the right to require headwalls and endwalls instead of flared end sections or vice versa.
- ___ Minimum stormwater easement width shall be determined per guidelines (Section 8.0, Stormwater Design Criteria). No combined easements are allowed. Overlapping easements are allowed, as long as any structures for other utilities are located outside of the stormwater easement and all easements are labeled separately.

V. Street (refer to Section 9.0, Streets, for acceptable street types)

- ___ Provide all street centerline bearings and distances. Provide all centerline radii and length of curves.
- ___ Provide a typical cross section with pavement thickness.
- ___ Street names and State road numbers if applicable.
- ___ Existing pavement width (show shaded) dimensioned to back of curb (BOC).
- ___ Curve data with super elevation, runoff data and design speed.

- ___ Residential streets are designed without superelevation. If superelevation is desired or needed, submit a sketch to City Engineering indicating why this is needed.
- ___ Existing and proposed centerlines (if different or new streets are proposed), curb and gutter, edge of pavement, driveways (with widths and material type), sidewalks, handicap ramps, etc. (All center line information shall contain bearing and distance as well as all horizontal curve information).
- ___ Stations along centerline and at special features (point of tangent, point of curve, catch basins, centerline point of intersection, low/high point, etc.).
- ___ Taper and lane storage lengths shown. Calculations of lengths to be placed directly on drawings.
- ___ Obstructions labeled.
- ___ Posted speed limits for widening of existing streets.
- ___ Design speed of new streets.
- ___ Utilities identified and labeled.
- ___ Trees and shrubs shown and labeled to remain and those to be removed.
- ___ Street intersection turnouts with radii.
- ___ Proposed elevations and grades around cul-de-sac and street intersection radii.
- ___ Street width (back of curb), right-of-way width and all street intersection radii.
- ___ Signing and Pavement Markings Sheet (when necessary, see Section 10.0, Transportation).
- ___ At all road stubs to adjacent properties where required by the Public Works Department, the consultant shall provide all requested future street profiles for review and approval.

SECTION 2.5

CONSTRUCTION DRAWING PROFILE CHECKLIST

Note that plan and profile must be shown on the same sheet and must be shown in the same direction.

Profile drawings are required when:

- ___ The improvements are to be public.
- ___ Sanitary sewer lines that are to be permitted.
- ___ Private water lines where they cross the sanitary sewer lines (a cross-section is acceptable or dimension if crossing is on the plan view).
- ___ Private streets are proposed.
- ___ When the City Engineering Division determines that it is required to adequately design the improvements.

A registered Professional Engineer with the State of North Carolina shall prepare the plans (signed and sealed) for improvements to the water mains, sewer mains, street improvements and storm drainage systems and structures. A registered Professional Land Surveyor or Landscape Architect with the State of North Carolina may also be used to prepare street improvements and storm drainage systems and structures (see also Sections 2.4, Construction Drawing Plan Checklist, 5.0, Water Supply/Distribution, 7.0, Sanitary Sewer System, 8.0, Stormwater Design Criteria, 8.1, Peak Runoff Rate Increases, 8.2, Neuse River Basin Performance Standards, 8.3, Stormwater Control Facilities (BMPs), 8.4, Stormwater BMP Design Summaries, and 9.0, Streets). *The following is intended as a guide in the preparation and submitting of plans for improvements for water lines, sewer lines, street construction and storm drainage system and structures.* The City Engineering Division's position is one of review and not of detailed checking. Plans found deficient will result in the rejection of the plans and could delay the entire approval process.

I. General

- ___ Plan view, required for all profile drawings (see Section 2.4, Construction Drawing Plan Checklist).
- ___ The plan view is to be at the top and the profile view is to be at the bottom of the sheet (see plan profile sheet at the end of this section for general layout and configuration).
- ___ For all improvements:
- ___ Sheet size to be 24-inch by 36-inch.
- ___ The scale shall be: 1-inch = 40-feet horizontally and 1-inch = 4-feet vertically. Show the scale both numerically and graphically.
- ___ Elevations shall be labeled in 10-foot intervals on the heavy lines (Ex. 360, 370).
- ___ Existing centerline profile shall be extended adequately to design future extensions (300-feet preferred).
- ___ Existing paved roads are to be bored for water and sanitary sewer crossings. Show/label and dimension encasement pipe and carrier pipe and vertical clearance to other pipes crossed.
- ___ All labels shall be legible and horizontal or vertical. The bottom of all labels shall face toward the bottom of the sheet or the right side of the sheet, whichever is applicable.

II. Water Mains

- ___ Existing water lines shown with size and type.
- ___ Proposed water lines shown with size and type.

- ___ Show minimum cover for proposed underground utilities (3-feet minimum or as required by the Engineering Division).
- ___ Waterlines above sewer lines.
- ___ Show minimum clearance between utilities:
 - ___ 18-inches vertical above sanitary sewer lines or 10-feet horizontal from sanitary sewer line.
 - ___ 24-inches from storm drainage lines.
- ___ Waterlines below sanitary sewer lines (sanitary lines shall be ductile iron for 10-feet on either side of crossing).

III. Sanitary Sewer Mains

- ___ Existing sanitary sewer lines shown with size and type.
- ___ Proposed sanitary sewer lines shown with size and type.
- ___ Show sanitary sewer grades, inverts at manholes, lengths, rims, etc.
- ___ Show intersecting inverts and label invert elevations.
- ___ Show centerline of intersecting streets with stations.
- ___ Check grades and inverts for accuracy.
- ___ Indicate 100-year flood elevation (reference FEMA panel #, date).
- ___ Show manhole rims 2-feet above 100-year flood elevation.
- ___ All manholes not in street right-of-way to be 3-feet above finished grade.
- ___ Add shading to all ductile iron pipe sanitary sewer lines in profiles to distinguish DIP material from PVC material.
- ___ DIP used as force mains to be lined with “Protecto 401” or equivalent.

IV. Storm Drainage

- ___ Submit drainage calculations (see Section 8.0, Stormwater Design Criteria, for required drainage calculations).
- ___ Show existing drainage to remain with inverts, size, etc.
- ___ Show proposed drainage with inverts, grades, size, length, etc.
- ___ Maintain a minimum of 1% grade on storm drainage pipes. Further calculations will be required for grades less than 1%, but only with Stormwater Services Approval.
- ___ Easements required when pipe or channel collects stormwater from a public right-of-way. Easement width to be determined Section 8.0, Stormwater Design Criteria). See Section 12.0, Standard Notes, for storm easement note.

V. Street Design

- ___ Typical section of proposed street if not already shown on plan (refer to Section 9.0, Streets, for acceptable street types).
- ___ Existing and proposed centerline profile.
- ___ Existing top of curb profile.
- ___ Proposed centerline vertical curve information (VPI, VPC, VPT, Elevation, L, DS based on

AASHTO and K value). Show TOC elevations at locations not covered by centerline vertical curve information.

- ___ Proposed grade lines with percent grade shown.
- ___ Maintain a minimum of 0.7% grade.
- ___ Existing elevations shown along centerline, right right-of-way and left right-of-way.
- ___ Profile shall be projected straight down from plan view whenever possible.
- ___ Show street intersection turnouts in the profile with elevations given at PC, 1/4, 1/2, 3/4, PT.
- ___ At all road stubs to adjacent properties where required by the Public Works Department, the consultant shall provide all requested future street profiles for review and approval.

View a typical plan profile sheet. It is in PDF format - [Acrobat Reader](#) required.

SECTION 3.0

PERMITTING PROCESS

This section is intended to describe the permitting process and which items need to be permitted through the Engineering Division and which may need input from other agencies. The permitting process can start only after the plans have completed the Section 2.1, Construction Plan Approval Process. For the fee structure, refer to Section 14.0, Fees.

I. Building Permit

A. Single Family

Contact City/County Building Inspections for a building permit or a building moving permit application and submittal procedure. If the project is a new or revised site plan in Durham City or Durham County the City/County Planning Department should be the first point of contact. The Planning Department will determine if the site requires other type of plan submittals.

B. Multi-family/Commercial Sites

Contact City/County Building Inspections for a building permit application.

The Engineering Division will not review the building permit application until:

1. Site has a valid site plan approval.
2. Construction drawings (if required) have been submitted to the Engineering Division.

II. Moving and Demolition Permits and Information

- A. When moving a structure, contact City/County Building Inspections for a Moving Permit Application. This completed form shall be submitted to the Engineering Division, along with a completed Engineering Moving Information Form (see Section 13.0, Forms) and other appropriate paperwork. The Moving Permit must be sent to numerous other departments and utilities listed on the application.
- B. When demolishing a structure, complete the Engineering Demolition Information Form and submit it with a drawing showing existing conditions. Highlight locations of all utilities. Refer to Section 5.0, Water Supply/Distribution, and Section 7.0, Sanitary Sewer System, for information regarding abandonment of water service and sewer service, respectively. All services shall be terminated per Section 5.0, Water Supply/Distribution, and 7.0, Sanitary Sewer System.

III. Driveway Permits

A. City (Single Family House)

Only for new driveway construction onto a city street. Submit to the City Engineering Division by telephone or by facsimile the street address a minimum of 24 hours before starting construction. The permit can be picked up when the permit fee is paid. The permit is valid if work is to begin within 30 days of being issued.

B. City (Multi-family/Commercial):

1. For previously approved site plans, the permit can be applied for immediately. Bring a copy of the stamped, approved site plan indicating Planning Department's sign off. The permit will be issued within 24 hours.
2. For new driveway cuts onto city streets that do not require complete construction drawings (as indicated in the Section 2.2, Construction Plan Submittal Requirements) follow the following approval process:

- a. Submit to Engineering Development Review a copy of a site plan for the proposed driveway for review and approval (allow a maximum of two weeks).
- b. After approval of a site plan, a permit can be applied for at the Public Works Department's front desk; typical turnaround time is 24 hours.
- c. Contact Engineering Inspections Department 48 hours before starting work to schedule an inspection.

C. State

1. Part of the NCDOT driveway application is securing an approval with signature by the Engineering Division. All NCDOT driveway applications ***shall*** be submitted with one copy of a signed, stamped and approved valid site plan by the Durham City/ County Planning Department. ***All permits shall be completely filled out in order to be signed.*** Normal turn-around time for a driveway permit is 24 hours.
2. If the road is state maintained contact the NCDOT office (telephone number listed under Directory) for a permit application.

IV. License Agreements (also known as Encroachment Agreements for State Roads)

A. City

Only for encroachments of private utilities (such as irrigation systems or private communication lines) within the right-of-way of a city street. Refer to the License Agreement Application (a copy of the agreement application is located in Section 13.0, Forms).

B. State

Referred to as Encroachment Agreements and are required for all work located inside the right-of-way of a state maintained road. Contact NCDOT office for a listing of their requirements.

V. Right-of-Way Inspections:

Prior to issuing an occupancy permit by the City/County Building Inspections Department, a right-of-way inspection is required by Engineering Inspection Section. Contact the City Engineering Inspection office.

VI. Sanitary Sewer Permits (NPDES Sewer Extension Permit)

A. General

This section is to include sanitary sewer main extensions (private and public). All sanitary sewer mains plans must have City or County Engineering approval before proceeding with permit application. Refer to Section 2.1, Construction Plan Approval Process, and Section 7.0, Sanitary Sewer System, for more detail.

No person shall do any of the following things or carry out any of the following activities until or unless they have applied for and have received from the City a permit and complied with such conditions, if any, as are prescribed by such permit:

1. Construct any sanitary sewer system within the City's utility service area if the system is to be connected to the City sanitary sewer system;
2. Alter, extend or change the construction or method of operation of any sanitary sewer system within the City's utility service area if the system is, or is to be connected to the City sanitary sewer system;
3. Enter into a contract for the construction and installation or the alteration or extension, of any sanitary sewer system that both is within the City's utility service area and is to be connected with the City sanitary sewer system.

B. City (gravity)

The City of Durham Engineering Division has been delegated by the State of North Carolina to permit sanitary sewer lines for the state within the City's collection system. All sanitary sewer lines extending from the City of Durham sanitary sewer collection system that fit the definition of a collection system require a sanitary sewer permit before starting sanitary sewer installation. Collection systems shall be as defined by Title 15A of the North Carolina Administrative Code, Subchapter 2H.

If a sanitary sewer permit is required complete the following procedure:

1. Section 2.1, Construction Plan Approval Process.
2. Submit to the Engineering Division:
 - a) A complete sanitary sewer permit application (a copy of a permit application is located in Section 13.0, Forms). A separate permit needs to be completed for a private system and a public system.
 - i) Owner shall sign application
 - ii) NCPE shall sign and seal application
 - b) A check in the amount of \$400 made payable to the City of Durham for each permit application. For example, if a project had a public and a private sanitary sewer distribution system, check in the amount of \$800 is required (2 permits at \$400 each).
 - c) Appropriate number of City of Durham Engineering Division approved construction documents.
3. Permit applications are generally reviewed within 10 business days of receipt.

C. City (Pump Stations)

For projects using sanitary sewer pump stations, the applicant shall contact the City Engineering Division prior to submittal of site plan or construction plans. This is to determine if the station is to be public or private and what special requirements might be needed. Be advised that this process takes a longer time to complete since the State will need to review and issue the permit.

1. Complete Section 2.1, Construction Plan Approval Process.
2. Submit a complete state pump station permit application, listing the City of Durham as the owner.
3. Submit a check in the amount of \$400 made payable to NCDENR.
4. Submit 2 complete sets of approved plans and specifications.

D. County (gravity)

The County of Durham operates a sanitary sewer collection system in the southeast section of Durham County. For collection systems in this area plans should be submitted simultaneously to the City Engineering Division and the County Engineering Division. Contact City Engineering to confirm jurisdiction. After the plans have been approved, the applicant shall forward the plans to the state. Coordinate approvals with the County Engineering Division.

E. County (Pump Stations)

The County of Durham operates a sanitary sewer collection system in the southeast section of Durham County. For collection systems in this area plans should be submitted simultaneously to the City Engineering Division and the County Engineering Division. Contact Durham Engineering Division to confirm jurisdiction. After the plans have been approved the applicant shall forward the plans to the state. Coordinate approvals with the County Engineering Division at (919) 560-7993.

F. County (septic)

Contact the Durham County Health Department for a listing of their requirements.

G. Industrial Wastewater Discharge Permit

All industrial users and any other users who discharge wastewater that exceeds the domestic waste concentration as specified in Sec 23-103 of the City's Sanitary Sewer Use Ordinance shall request an industrial user discharge determination from the Industrial Waste Control Section of the Water Management Department.

An Industrial Wastewater Survey and Permit Application package can be obtained by calling the Water Management Department at (919) 560-4381. Based on the information submitted, a determination will be made and a permit will be issued within 180 days from date of completed application. No wastewater discharge is allowed until the Industrial Wastewater Discharge Permit is issued or a determination is made that a permit is not required.

Conditions governing Industrial Wastewater Discharge, permit application process and applicable fees are contained in the City's Sanitary Sewer Use Ordinance and can be obtained from the Water Management Department.

VII. Soil and Erosion Control (Grading) Permit

Contact Durham County Sedimentation and Erosion Control office before doing any land disturbing activity anywhere in Durham County (including inside City) to verify if a permit or a plan is needed. Any disturbance over 12,000 square feet requires a permit and any disturbance over 1 acre requires a plan and a permit.

VIII. Stormwater

A. Drainage Permits for any drainage work that does not require a site plan from the City/County Planning Department pertaining to work on individual properties (channels, pipes, culverts-15" or larger, inlets, etc.) not including Water Quality/Water Quantity Basins.

These plans only have storm drainage improvements.

1. Submit three sets of plans and two sets of calculations to Stormwater Services for approval.
2. The permit can be picked up within 24 hours at the front desk of the Public Works Department upon completion of #1 above.
3. Contact the Engineering Inspections Department 48 hours before starting work to schedule a pre-construction conference.

B. Stormwater Control Facilities (BMPs)

See Section 8.0, Stormwater Design Criteria, through Section 8.4, Stormwater BMP Design Summaries, for a complete listing of requirements needed for facilities. It is highly recommended this process be started as early as possible. There is a permit fee (listed in Section 14.0, Fees), surety and operation and maintenance agreement required before any construction drawings will be approved.

IX. Water Permits

A. General

Plans must have City Engineering approval before proceeding with permit application. Refer to Section 2.1, Construction Plan Approval Process, and Section 5.0, Water Supply/Distribution, for more detail.

No person shall do any of the following activities until or they have applied for and have received

from the City of Durham a permit and shall have complied with such conditions, if any, as are prescribed by such permit:

1. Construct any water system within the City's utility service area if the system is to be connected to the City water system;
2. Alter, extend or change the construction or method of operation of any water system within the City's utility service area if the system is, or is to be connected to the City water system; or
3. Enter into a contract for the construction and installation or the alteration or extension, of any water system that both is within the City's utility service area and is to be connected to the City water system.

B. City

The City of Durham Engineering Division has been delegated by the State of North Carolina to permit waterlines for the state within the City's distribution system. *The following waterlines will need a permit:*

1. Public or private waterline distribution systems as defined by NCDENR.
2. All fire lines;
 - a. That have taps on them outside of the building, or
 - b. That have fire hydrants
3. Lines that the City Engineering Division determines require a permit.

If a permit is required:

1. Complete Section 2.1, Construction Plan Approval Process;
2. Submit to the Engineering Division;
 - a) Complete water permit application (a copy of a permit application is located in the section entitled Section 13.0, Forms). A separate permit shall be completed for a private system and a public system.
 - i) Owner shall sign application
 - ii) NCPE shall sign and seal application
 - b) A check in the amount of \$200 made payable to the City of Durham for each permit application. For example, if a project had a public and a private water distribution system, 1 check in the amount of \$400 is required (2 permits at \$200 each).
 - c) Three (3) sets of approved plans by the City of Durham Engineering Division.
3. Permit applications are generally reviewed within 10 business days of receipt.

C. State

Required for all private waterline distribution systems with wells. Contact North Carolina Department of Environmental Health and Natural Resources for a listing of their requirements and/or the Durham County Health Department.

D. Cross-Connection

Refer also to the Section 6.0, Cross Connection Control. Contact Water Management Department-Cross Connection Control for permit application. Cross connection permits are required for back-flow preventers which are required on all waterlines that are:

1. Greater than 50' of dead end line.
2. Fire lines.
3. Irrigation lines.
4. Lines as required by Cross-Connection.

X. Wetlands

Contact the U.S. Army Corps of Engineers if there is any possibility of wetlands on the site before starting any land planning. All wetlands shall be mapped and plans approved by the Corps of Engineers. An area is generally considered as potential wetlands if the site has floodplain, creeks (dry or wet weather), ponds or meets certain other criteria of the Corps of Engineers. Wetland mitigation plans may also be required. Note that it is the responsibility of the applicant to contact the U.S. Army Corps of Engineers and this should be done early in the planning process.

XI. Utility Mainline Construction Permits

This permit type shall be applied for by all utility companies that possess a franchise agreement to operate within the City of Durham limits and wish to install their utilities within the existing or proposed public right-of-way of a development. Permits shall be required when:

- A.** The proposed development is located within the current City limits and the proposed utility is to be placed within the public right-of-way and/or easement.
- B.** The proposed development is located outside the current City limits, but an annexation petition is being pursued.

Utility companies shall submit letters of application and plan drawings to the City Engineering Division. Permits shall be issued prior to the start of work.

XII. As-Built Approval

Before a sanitary sewer connection or water meter are installed and prior to issuance of certificate of occupancy, As-Built drawings must be approved. See Section 4.0 for as-built submittal requirements.

SECTION 4.0

AS-BUILT DRAWING SUBMITTAL REQUIREMENTS

Special provisions for as built approval:

Water meters and sanitary sewer connections shall not be installed without prior As-Built approval. Also, approved As-Built drawings are required for issuance of the certificate of occupancy.

As-built drawings shall include plans that were approved under Section 2.1, Construction Plan Approval Process. As-built drawings are required for:

- I. Public water mains, sanitary sewer systems, street improvements, stormwater control facilities and all stormwater conveyance systems (including open channel conveyance systems and all pipes 15-inches or larger in diameter; both inside and outside (on private property) the public right-of-way).
- II. As needed for individual permits issued if the permits require as-builts.

If as-built drawings are required, use the following procedure:

1. Submit three (3) sets of prints to the Public Works Department/Engineering Division for review, modified as follows:
 - a) Correct the drawings to the as-built condition. The corrections shall be legible.
 - b) Remove "Proposed" from all locations.
 - c) Horizontal distances should scale within 5-feet. Vertical distances should scale within 6-inches. Redraw items to correct locations, if actual location differs by more than this.
 - d) All installed pipe sizes, pipe materials and pipe locations shall be indicated (inverts or top elevations).
 - e) On the plan view, water connections shall be shown by dashed lines and sanitary sewer connections by solid lines.
 - f) Water meter and sanitary sewer service cleanout locations referenced to the nearest property lines to the nearest 0.1-feet.
 - g) If water-only project, connections should be located by station from nearest mainline valve or hydrant valve (Ex. WM 2+00). 0+00 shall be labeled at the valve where stationing begins with an arrow indicating the direction that stations run. Stations should generally run in the same direction for each street.
 - h) If sanitary sewer-only or water and sanitary sewer project, services should be located with distance from property corner or from station from nearest downstream manhole (Ex: W S 1+80).
 - i) On the plan view, show distances between all water line valves, tees, bends, etc. (EX: 500-feet valve to tee).
 - j) Water mains shall have a separate detail sketch on the plan view above all intersecting water mains and fire hydrants showing as-built distances between valves, hydrants, crosses, tees, etc.
 - k) Show as-built stations for all sanitary sewer and storm drainage manhole on plan view and profile view (Ex: MH Sta. 3+01.59).
 - l) Plan view for sanitary sewer and storm drainage shall have as-built manhole-to-manhole distances (Ex: 301.59 MH to MH). Distances shall be measured in the field from center of manhole cover to center of manhole cover.
 - m) Profile view shall have as-built manhole rim elevations for sanitary sewer outfalls (Ex: RIM 810.10).

- n) Profile view shall have as-built elevation for the all inverts for all sanitary sewer and storm drainage manholes (Ex: C/L MH INV 800.10). Elevations shall be shown for the invert at the top of the drop pipe for an outside drop manhole and for the vent pipe on a Type B manhole.
 - o) As-built MH-to-MH distances and invert elevations shall be used to compute as-built grades. Grades shall be carried out to two decimal places (Ex: 5.06%).
 - p) Major horizontal alignment changes shall be indicated on the plan view. For sanitary sewer, survey parties need to turn angles for major changes only. All sanitary sewer outfall sections shall have bearings, distances and easements noted.
 - q) Show as-built grades, inverts, rim elevations and locations of all storm drainage structures (storm lines, catch basins, yard inlets, culverts, etc).
 - r) Any horizontal or vertical changes in the street alignment or profile shall be shown if:
 - 1) The design speed is affected.
 - 2) The horizontal or vertical change is greater than 0.5-foot.
 - 3) Stormwater direction of flow is effected from original approved plans
 - s) Street names, lot numbers (as referenced on plat), right-of-way and street widths, etc. shall be labeled in plan view.
 - t) Remove all notes pertaining to copy write infringements and preventing photo copies of drawings.
2. After these plans have been reviewed and approved provide one set of reproducibles (5 mm thick) double mat mylar with corrections along with marked-up set if applicable. An electronic copy of the plan is also required in *.dxf format submitted on a compact disc. As-built certification must be signed and sealed by a North Carolina Professional Engineer or a Professional Land Surveyor.
- a) As-built certification statements in the form of:

Note: These certification statements must be executed by a registered NC Professional Engineer and/or Land Surveyor with experience in the design, construction, and survey of water systems, sanitary sewer systems, storm drainage conveyance systems and streets of a nature similar in scope to that certified to in this certification. Periodic observations of construction by the certifying registered NC Professional Engineer (or Designee) and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

FIELD SURVEY CERTIFICATION STATEMENT

I, _____, as a duly registered Professional Land Surveyor / Engineer (circle one) in the State of North Carolina, hereby certify that the data shown on this drawing, obtained under my supervision, is an accurate and complete representation of what was constructed in the field, that the physical dimensions or elevations shown thus are as-built conditions and the facility was constructed according to the approved plans, except otherwise noted hereon.

Name: _____ Date: _____

NC Registered Seal:

ENGINEER CERTIFICATION STATEMENT

I, _____, as a duly registered Professional Engineer in the State of North Carolina, having been authorized to observe (___ periodically, ___ weekly, ___ full time) the construction of the project, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that by my inspection of the constructed improvements and my review of the as-built survey data, I hereby certify that the (1)public improvements, (2) private improvements, and (3) public safety of the above referenced project as constructed are in compliance with the requirements of the improvements as prescribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the improvements.

Name: _____ Date: _____

NCPE Seal:

- **** 3. Submit electronic drawings and data files as described further on CD or DVD computer media, subject to the following requirements:
- a) Submit the following four items as part of the as-built digital submittal:
 - 1) Summary information file (**see item 4 below**).
 - 2) CAD file(s) that include all as-built structures within the project (**see item 5 below**).
 - 3) PDF files of each as-built drawing submitted for review (**see item 6 below**).
 - 4) Data files for water, sanitary sewer, and stormwater infrastructure (**see item 7 below**).
 - b) The CD (or DVD) shall have a permanent typewritten label (hand written labels will not be accepted due the issues regarding legibility) which contains the information listed below:
 - 1) The project name.
 - 2) Name of the firm which prepared the data.
 - 3) Date the CD (or DVD) was prepared.
 - c) Contents of the digital submission shall be organized on the media into the folders as described below.
4. Submit a summary information file. The summary information file is to be a ASCII file which contains the following items:
- 1) The project name.
 - 2) Name of the firm which prepared the data.

- 3) Date the CD (or DVD) was prepared.
- 4) Specification of two or more survey control monuments established and/or used for the project. This specification should include the following information for each survey control point:
 - a). Easting – East coordinate value (+/- 0.01')
 - b). Northing – North coordinate value (+/- 0.01')
 - c). Elevation – Elevation (+/- 0.01')
 - d). Description – A brief description of the control monument (including what type of monument it is, such as USGS, NCGS, LEC, WKD, or monument located for the project).
 - e). A statement that indicates the horizontal and vertical datum of the control monuments.
5. Submit one or more AutoCad/MicroStation (DGN, DWG, or DXG format) drawing files that contain all of the infrastructure (water, sewer, and stormwater) that was constructed during the project, as well as all other pertinent reference lines, project information, and survey control data. The infrastructure shall be drawn in the file at the as-built locations as surveyed and certified by the Professional Land Surveyor. The AutoCAD or MicroStation file(s) shall be placed into a folder named "CAD" on the submitted media. Please note: the delivered CAD files should not be of the Plan/Profile sheets, but should be the overall working drawing which is registered to North Carolina State Plane, NAD 1983
6. Submit one PDF file for each for each hard copy as-built drawing submitted according to specifications in items 1 and 2 above. The PDF file(s) shall be placed into a folder named "PDF" on the submitted media. The PDF must include the signature and seal of the engineer.
7. Submit as-built data for direct import into the City's Geographic Information System (GIS). This data shall consist of files in an ASCII Comma Separated Value (CSV) file format. The horizontal coordinate system for the digitally submitted data as described below shall be North Carolina State Plane (NAD83), U.S. Survey Feet. The vertical coordinate system for the digitally submitted data as described below shall be North American Vertical Datum, 1988 (NAVD 1988), U.S. Survey Feet. All of these file(s) shall be placed into a folder named "DATA" on the submitted media.

Several of the data files require the recording of materials for various pipes and structures. Please use the following standard codes where required:

Table 7.1. Material Codes

Code	Description
CA	Corrugated Aluminum
CM	Corrugated Metal
CON	Concrete (Precast)
CONB	Concrete Block
DI	Ductile Iron
HDPE	High Density Polyethylene
PVC	Polyvinyl Chloride
RC	Reinforced Concrete
VC	Vitrified Clay

- a). **Water Features**– The file shall be named "WaterFeatures" and contains various elements that connect and control the distribution of water within and among various water lines. These features include both buried fittings (bends, crosses, end caps, reducers, and tees) and features that are accessible and/or visible at the surface (meters, valves, and hydrants). Buried features should be located similar to the method our utility locators use: a paint dot is placed on the pavement at the approximate location of the feature and then surveyed location is taken at the paint mark.

Water line locations (“WATERLINE” type in the table below) are required only if the water line curves. These locations will be surveyed at 50 foot stations along the length of the water line.

Each line of the file shall contain the following information:

- 1) ID,Type,Easting,Northing,Elevation,Description (all on one line in the file)
- 2) Where;
 - a) ID - A unique ID number assigned to each feature noted on the as-built plan and profile sheets (i.e. GV-1, HYD-1, etc.).
 - b) Type-The type of feature. Provide the following codes as indicated in the table below:

Feature Description	Type
Bend	BEND
Blow Off	BLOWOFF
Cross	CROSS
End Cap	ENDCAP
Fire Hydrant	HYDRANT
Water Meter	METER
Reducer	REDUCER
Tee	TEE
Water Valve	VALVE
Water Line	WATERLINE

- c) Easting – East coordinate value (+/- 2.0’ if buried, +/- 0.1’ otherwise).
- d) Northing – North coordinate value (+/- 2.0’ if buried, +/- 0.1’ otherwise).
- e) Elevation – Elevation, collected as follows: (+/- 2.0’ if buried, +/- 0.1’ otherwise).

Feature Type	Elevation Location
BEND/BLOWOFF/CROSS/ END CAP/REDUCER/TEE	Surface, at the mark that indicates the approximate location of the buried feature.
HYDRANT	Base of the fire hydrant.
METER/VALVE	Center of the access structure.
WATERLINE	Surface, at the mark that indicates the approximate location of the buried line, at 50 foot stations. Only required if a water line is curved.

- f) Description-The description of the item for the feature; encoded as follows:

Feature Type	Size
BEND	Degree of bend (e.g. 11.25/22.5/45/90)
BLOWOFF	Size (in inches) of the blow off.
CROSS	Size (in inches) of each water line that connects to the cross (e.g. “12x12x8x8”)
ENDCAP	Size (in inches) of the water line.
HYDRANT	Manufacturer and year of manufacture. This information will be on the hydrant (e.g.

	“CLOW-2004”).
METER	The size (in inches) service lateral.
REDUCER	The size (in inches) of the lines on either side of the reducer (e.g. “8x4”)
TEE	The sizes (in inches) of each water line that connects to the tee (e.g. “12x12x8”)
VALVE	The size (in inches) of the valve.
WATERLINE	No description required.

- b). **Water Lines** – The file shall be named “WaterLines” and shall contain the following data. There is one line of data for each water line that connects two water features.

- 1) ID, InstallYear, Material, Size, WaterFeatureID1, WaterFeatureID2 (all on one line in the file)
- 2) Where;
 - a) ID – A unique number assigned to each section of water line noted on the as-built plan and profile sheets (i.e. “WL-1”).
 - b) InstallYear – Year installed.
 - c) Material – Water line material (see table 7.1 above).
 - d) Size – The size (in inches) of the water line.
 - e) WaterFeatureID1-The ID of the feature on the near end of the water line as shown on the as-built plans (i.e. “GV-1”).
 - f) WaterFeatureID2-The ID of the feature on the far end of the water line as shown on the as-built plans (i.e. “HYD-1”).

- c). **Sewer Features** – The file shall be named “SewerFeatures” and shall contain information about manholes and clean outs. There is one line of data for each sewer feature.

- 1) ID, Type, Easting, Northing, Elevation, Invert, Diameter, Material (all on one line of file).
- 2) Where;
 - a) ID – If the feature is a manhole then the number as shown on the as-built drawings (i.e. “MH-1”). If feature is a clean out then a lot number or street address (i.e. “LOT10” or “123 Street Name”).
 - b) Type – The feature type, coded according to the following table:

Feature Description	Type
Sewer Clean Out	CLEANOUT
Sewer Manhole	MANHOLE

- c) Easting – East coordinate value (+/- 0.1’).
- d) Northing – North coordinate value (+/- 0.1’).
- e) Elevation – Rim elevation at the center of cover (+/- 0.1’).

Feature Type	Elevation Location
CLEANOUT	Ground
MANHOLE	Rim

- f) Invert – Invert elevation (+/- 0.1’, required only for manholes).
- g) Diameter – Interior diameter (in inches).
- h) Material – Construction material (see table 7.1 above).

- d). **Sewer Pipes** - The file shall be named “SewerPipes” and shall contain the following data. There is one line of data for each sewer pipe.

- 1) ID,Diameter,InstallYear,Material, UpstreamManhole,DownstreamManhole, UpstreamInvertElevation,DownstreamInvertElevation (all on one line in the file)
 - 2) Where;
 - a) ID – A sequential pipe number as noted on the as-built drawings (i.e. “SSP-1”).
 - b) Diameter – Inside Pipe diameter (inches).
 - c) InstallYear – Year installed.
 - d) Material – Pipe material (see table 7.1 above).
 - e) UpstreamManhole – Upstream manhole number as shown on the as-built drawings (i.e. “MH-1”).
 - f) DownstreamManhole - Downstream manhole number as shown on the as-built drawings (i.e. “MH-2”).
 - g) UpstreamInvertElevation – Invert elevation at the upstream end.
 - h) DownstreamInvertElevation – Invert elevation at the downstream end.
- e). **Storm Water Features** – The file shall be named “StormwaterFeatures. A storm water feature is either a combination inlet, curb inlet, drop/yard/grate inlet (cast iron grate cover with slotted openings), manhole, riser pipe, or slab inlet (solid concrete cover, supported on the corners with side flow entry). There is one line of data for each storm water structure.

- 1) ID,Type,Easting,Northing,Elevation,InvertElevation,Material (all on one line in the file)
- 2) Where;
 - a) ID – Structure number as shown on the as-built drawings (i.e. “SWMH-1”, “CB-2”, “YI-4”, “DI-3”).
 - b) Type – Type of storm water feature, to be encoded according to the following table:

Feature Description	Type
Frame and grate inlet	COMBINATION INLET
Curb inlet (frame, no grate)	CURB INLET
Drop/grate/yard inlet (grate flush with ground)	DROP INLET
End section (flared or head wall)	END SECTION
Junction box	JUNCTION BOX
Manhole	MANHOLE
Pond outlet riser/wier	RISER PIPE
Slab inlet	SLAB INLET

- c) Easting – East coordinate value (+/- 0.1’).
- d) Northing – North coordinate value (+/- 0.1’).
- e) Elevation – Elevation, collected as follows: (+/- 0.1’).

Feature Type	Elevation Location
COMINATION INLET	Back of curb, center of box
CURB INLET	Back of curb, center of box
DROP INLET	Center of grate
END SECTION	Top of end section
JUNCTION BOX	Center of cover
MANHOLE	Center of cover
RISER PIPE	Top of the riser/wier
SLAB INLET	Top of slab, center of box

- f) InvertElevation – The invert elevation.
- g) Material – Construction material (see table 7.1 above).

- f). **Storm Water Pipes** – The file shall be named “StormwaterPipes” and shall contain the following data. There is one line of data for each storm water pipe.
- 1) ID,Diameter,InstallYear,Material,UpstreamFeatureID,DownstreamFeatureID,UpstreamInvertElevation,DownstreamInvertElevation (all on one line in the file)
 - 2) Where;
 - a) ID – A sequential pipe number as noted on the as-built drawings (i.e. “SWP-1”).
 - b) Diameter – Pipe diameter (inches).
 - c) InstallYear – Year installed.
 - d) Material – Pipe material (see table 7.1 above).
 - e) UpstreamFeatureID – Upstream feature ID number as shown on the as-built drawings (i.e. “SWMH-1”).
 - f) DownstreamFeatureID - Downstream feature ID number as shown on the as-built drawings (i.e. “CB-2”).
 - g) UpstreamInvertElevation – Invert elevation at the upstream end.
 - h) DownstreamInvertElevation – Invert elevation at the downstream end.
- g) **Storm Water Channels (constructed channels)** – The file shall be named “StormwaterChannels” and shall contain the following data. Each line of the file shall correspond to a location collected at 25 foot stations along the centerline of the open channel. Each line of the file shall contain the following information;

- 1) ID,Easting,Northing,Elevation (all on one line)
- 2) Where;
 - a) ID – is a unique number assigned to each section of open channel. The ID for an open channel changes at any intersection with another open channel and/or stormwater structure.
 - b) Easting – East coordinate value (+/- 0.1’).
 - c) Northing – North coordinate value (+/- 0.1’).
 - d) Elevation – Elevation at the bottom of the channel (+/- 0.1’).

Please go to http://www.ci.durham.nc.us/departments/works/digital_submittal_info.cfm for “Frequently asked questions” and an “Example Project file”.

SECTION 4.1

WET DETENTION FACILITY AS-BUILT DRAWINGS

As-built drawings shall include plans that were approved under Section 2.1, Construction Plan Approval Process.

Use the following procedure for submitting as-built drawings (Note that all items are to be submitted electronically on a compact disc in AutoCAD format and *.pdf format):

1. Submit one (1) set of as-built drawings to the Public Works Department - Stormwater Services Division for review with the following items included:
 - a) Provide as-built grades, inverts, sizes, lengths, widths, materials, rim elevations and locations of all storm drainage structures (risers, outlet pipes, weirs/spillways, etc), details of the trash rack/surface baffle/or similar device; all elevations shall be actual elevations, not relative elevations.
 - b) Provide facility bottom elevation with associated area in ft².
 - c) Provide inside aquatic bench elevation with facility area in ft² and the width of the bench.
 - d) Provide outside aquatic bench elevation with facility area in ft².
 - e) Provide the water surface area at the elevation of the normal pool in ft².
 - f) Provide top of dam elevation with associated facility area in ft² and embankment top width. Top of dam spot elevations are required at 10-foot intervals and impoundment and forebay area soundings performed on a 25-foot x 25-foot grid pattern.
 - g) Provide all side slopes (H:V) for facility embankments.
 - h) Provide a plan view of the facility showing the constructed grading.
 - i) Provide the volume of the forebay.
 - j) Provide a profile through the forebay, main body and spillway with elevations.
 - k) If the elevations of the outlet structures or sizes of the outlet structures differ from the approved construction drawings, a revised routing analysis shall be provided on 8.5-inch by 11-inch sheets, using surveyed elevations at 1.00-foot increments.
 - l) If surveyed facility volumes are less than the approved construction drawings, a revised routing analysis shall be provided submitted on 8.5-inch by 11-inch sheets, using surveyed surface areas at 1.00-foot increments.
 - m) Provide an as-built drainage area map that shows the drainage area draining into the stormwater control facility.
 - n) One (1) copy of the revised summary sheet for the facility based on as-built construction conditions. The summary is to be signed and sealed by an NCPE.
 - o) One (1) copy of the survey plot, including all spot shots, of the facility.
 - p) An original completed copy of the signed and sealed General Certification Inspection Checklist.
 - q) An as-built certification, as shown on the following page, signed and sealed by a North Carolina Registered Professional Engineer.
 - r) Copies of all dam embankment material composition and density testing paperwork, including a map that labels all points where the dam and dam foundation areas were tested.
 - s) Copies of all concrete compressive strength testing paperwork for any cast-in-place concrete items associated with the construction of the dam or outlet works.
 - t) One (1) copy of the purchase receipt for the pipe used as the principal spillway pipe. The purchase receipt should identify the ASTM specifications governing the manufacture of the pipe.

- u) One (1) copy of the manufacturer's certification of any armoring, other than concrete, used to armor the emergency spillway.
 - v) Colored photographs showing the completed facility and of the dam foundation areas, the riser, the principal spillway pipe, the concrete cradle, the seepage diaphragm, relief drains, etc, as those items were being prepared and/or installed.
 - w) One (1) copy of the Geotechnical Engineer's resume if a Geotechnical Engineer is required to provide the certification.
 - x) An original signed and sealed Geotechnical Certification, as shown in the following pages.
 - y) One (1) copy of the landscape company's letter, as applicable, certifying the installation of the specific plants required at the facility.
 - z) One (1) copy of the approved Construction Drawings and Supporting Calculations, including the drainage area map, for the facility.
 - aa) One (1) copy of the summary sheet for the facility as presented in the Construction Drawing design documents.
2. After these plans have been reviewed and approved provide one set of reproducibles (5 mm thick) double mat mylar with corrections along with marked-up set if applicable. An electronic copy of the plan is also required in *.dxf format submitted on a compact disc.

General As-Built and Construction Certification

BMP Facility Name: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction or operation of stormwater BMPs of a nature similar in scope to that certified to in this certification. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon (1) my inspection of the constructed facility, (2) my review of the as-built survey data, (3) my review of the drainage area treated or managed by the facility, and (4) my analysis of the hydraulic performance of the constructed facility, I hereby certify that the (1) hydrologic and hydraulic, (2) geometric, (3) public safety, (4) facility access, and (5) vegetative elements of the constructed facility are in compliance with the requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the facility.

Name: _____ Date: _____

BCE #: _____ NCPE Seal:

Geotechnical Certification

BMP Facility Name: _____

Dam Class: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction of small earth dams of a nature similar in scope to that certified to in this certification. For Class A, B, and C dams, with the exception of Class C dams that serve a detention only function and that drain an area less than 25-ac, this certification must be executed by a geotechnical engineer. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon my observation and monitoring of the construction of the dam embankment for this facility, I hereby certify that the constructed facility is in compliance with the geotechnical requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and any approved modifications.

Name: _____ Date: _____

NCPE Seal:

SECTION 4.2

SAND FILTER AS-BUILT DRAWINGS

As-built drawings shall include plans that were approved under Section 2.1, Construction Plan Approval Process.

Use the following procedure for submitting as-built drawings (Note that all items are to be submitted electronically on a compact disc in AutoCAD format and *.pdf format):

1. Submit one (1) set of as-built drawings to the Public Works Department - Stormwater Services Division for review with the following items included:
 - a) Provide as-built grades, inverts, sizes, lengths, widths, materials, rim elevations and locations of all storm drainage structures (risers, outlet pipes, weirs/spillways, etc), details of the trash rack/surface baffle/or similar device; all elevations shall be actual elevations, not relative elevations.
 - b) Provide bottom elevation of sediment chamber with surface area in ft².
 - c) Provide the overflow weir invert elevation to sand bed.
 - d) Provide the volume of the sediment chamber to the overflow weir invert elevation.
 - e) Provide bottom elevation of bottom of sand bed with surface area in ft².
 - f) Provide the elevation at the top of the sand bed with surface area in ft².
 - g) Provide the side slopes (H:V) for the sediment chamber and sand chamber.
 - h) Provide the top elevation of the sediment chamber and sand chamber with surface areas in ft².
 - i) Provide a profile through the sediment chamber, sand chamber and spillway with elevations.
 - k) Provide a plan view of the sediment chamber and sand chamber showing the constructed grading.
 - l) If the elevations of the outlet structures or sizes of the outlet structures differ from the approved construction drawings, a revised routing analysis shall be provided submitted on 8.5-inch by 11-inch sheets. Provide actual stage/discharge rating curves and tables on 8.5-inch by 11-inch sheets based on the surveyed information at 0.50-foot increments.
 - m) If the surveyed pond volumes are less than the approved construction drawings, a revised routing analysis shall be provided submitted on 8.5-inch by 11-inch sheets. Provide actual stage/storage rating curves and tables on 8.5-inch by 11-inch sheets based on the surveyed data at 0.50-foot increments.
 - n) Provide an as-built drainage area map that shows the drainage area draining into the stormwater control facility.
 - o) One (1) copy of the revised summary sheet for the facility based on as-built construction conditions. The summary is to be signed and sealed by an NCPE.
 - p) One (1) copy of the survey plot, including all spot shots, of the facility.
 - q) An original completed copy of the signed and sealed General Certification Inspection Checklist.
 - r) An as-built certification, as shown on the following page, signed and sealed by a North Carolina Registered Professional Engineer.
 - s) Copies of all dam embankment material composition and density testing paperwork, including a map that labels all points where the dam and dam foundation areas where tested.
 - t) Copies of all concrete compressive strength testing paperwork for any cast-in-place concrete items associated with the construction of the dam or outlet works.
 - u) One (1) copy of the purchase receipt for the pipe used as the principal spillway pipe. The purchase receipt should identify the ASTM specifications governing the manufacture of the pipe.

- v) One (1) copy of the manufacturer's certification of any armoring, other than concrete, used to armor the emergency spillway.
 - w) Colored photographs of the completed facility and, in the instance of an open sand filter, photographs of the dam foundation areas, the riser, the principal spillway pipe, the concrete cradle, the seepage diaphragm, relief drains, etc, as those items were being prepared and/or installed.
 - x) One (1) copy of the Geotechnical Engineer's resume if a Geotechnical Engineer is required to provide the certification.
 - y) An original signed and sealed Geotechnical Certification, as shown in the following pages.
 - z) One (1) copy of the landscape company's letter, as applicable, certifying the installation of the specific plants required at the facility.
 - aa) One (1) copy of the approved Construction Drawings and Supporting Calculations, including the drainage area map, for the facility.
 - bb) One (1) copy of the summary sheet for the facility as presented in the Construction Drawing design documents.
2. After these plans have been reviewed and approved provide one set of reproducibles (5 mm thick) double mat mylar with corrections along with marked-up set if applicable. An electronic copy of the plan is also required in *.dxf format submitted on a compact disc.

General As-Built and Construction Certification

BMP Facility Name: _____

Note 1: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction or operation of stormwater BMPs of a nature similar in scope to that certified to in this certification. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

Note 2: The certification of a sand filter in the City of Durham does not currently require certification by a registered NC Professional Engineer certified as a BMP Certifying Engineer (BCE). It should be noted, though, that certification by a BCE may be required as the BCE program is expanded to include facilities in addition to dry ponds, wet ponds, and pocket/constructed wetlands.

CERTIFICATION STATEMENT

Based upon (1) my inspection of the constructed facility, (2) my review of the as-built survey data, (3) my review of the drainage area treated or managed by the facility, and (4) my analysis of the hydraulic performance of the constructed facility, I hereby certify that the (1) hydrologic and hydraulic, (2) geometric, (3) public safety, (4) facility access, and (5) vegetative elements of the constructed facility are in compliance with the requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the facility.

Name: _____ Date: _____

NCPE Seal:

Geotechnical Certification

BMP Facility Name: _____

Dam Class: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction of small earth dams of a nature similar in scope to that certified to in this certification. For Class A, B, and C dams, with the exception of Class C dams that serve a detention only function and that drain an area less than 25-ac, this certification must be executed by a geotechnical engineer. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon my observation and monitoring of the construction of the dam embankment for this facility, I hereby certify that the constructed facility is in compliance with the geotechnical requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and any approved modifications.

Name: _____ Date: _____

NCPE Seal:

SECTION 4.3

DRY DETENTION FACILITY AS-BUILT DRAWINGS

As-built drawings shall include plans that were approved under Section 2.1, Construction Plan Approval Process.

Use the following procedure for submitting as-built drawings (Note that all items are to be submitted electronically on a compact disc in AutoCAD format and *.pdf format):

1. Submit one (1) set of as-built drawings to the Public Works Department - Stormwater Services Division for review with the following items included:
 - a) Provide as-built grades, inverts, sizes, lengths, widths, materials, rim elevations and locations of all storm drainage structures (risers, outlet pipes, weirs/spillways, etc), details of the trash rack/surface baffle/or similar device; all elevations shall be actual elevations, not relative elevations.
 - b) Provide facility bottom elevation with associated area in ft².
 - c) Provide top of dam elevation with associated facility area in ft² and embankment top width. Top of dam spot elevations are required at 10-foot intervals.
 - d) Provide all side slopes (H:V) for facility embankments.
 - e) Provide a plan view of the facility showing the constructed grading.
 - f) Provide a profile through the facility and spillway with elevations.
 - g) If the elevations of the outlet structures or sizes of the outlet structures differ from the approved construction drawings, a revised routing analysis shall be provided on 8.5-inch by 11-inch sheets, based upon the surveyed information at 1.00-foot increments.
 - h) If the surveyed facility volumes are less than the approved construction drawings, a revised routing analysis shall be provided submitted on 8.5-inch by 11-inch sheets, based upon the surveyed surface areas at 1.00-foot increments.
 - i) Provide an as-built drainage area map that shows the drainage area draining into the stormwater control facility.
 - j) One (1) copy of the revised summary sheet for the facility based on as-built construction conditions. The summary is to be signed and sealed by an NCPE.
 - k) One (1) copy of the survey plot, including all spot shots, of the facility.
 - l) An original completed copy of the signed and sealed General Certification Inspection Checklist.
 - m) An as-built certification, as shown on the following page, signed and sealed by a North Carolina Registered Professional Engineer.
 - n) Copies of all dam embankment material composition and density testing paperwork, including a map that labels all points where the dam and dam foundation areas where tested.
 - o) Copies of all concrete compressive strength testing paperwork for any cast-in-place concrete items associated with the construction of the dam or outlet works.
 - p) One (1) copy of the purchase receipt for the pipe used as the principal spillway pipe. The purchase receipt should identify the ASTM specifications governing the manufacture of the pipe.
 - q) One (1) copy of the manufacturer's certification of any armoring, other than concrete, used to armor the emergency spillway.
 - r) Colored photographs showing the completed facility and the dam foundation areas, the riser, the principal spillway pipe, the concrete cradle, the seepage diaphragm, relief drains, etc, as those items were being prepared and/or installed.

- s) One (1) copy of the Geotechnical Engineer's resume if a Geotechnical Engineer is required to provide the certification.
 - t) An original signed and sealed Geotechnical Certification, as shown in the following pages.
 - u) One (1) copy of the landscape company's letter, as applicable, certifying the installation of the specific plants required at the facility.
 - v) One (1) copy of the approved Construction Drawings and Supporting Calculations, including the drainage area map, for the facility.
 - w) One (1) copy of the summary sheet for the facility as presented in the Construction Drawing design documents.
2. After these plans have been reviewed and approved provide one set of reproducibles (5 mm thick) double mat mylar with corrections along with marked-up set if applicable. An electronic copy of the plan is also required in *.dxf format submitted on a compact disc.

General As-Built and Construction Certification

BMP Facility Name: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction or operation of stormwater BMPs of a nature similar in scope to that certified to in this certification. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon (1) my inspection of the constructed facility, (2) my review of the as-built survey data, (3) my review of the drainage area treated or managed by the facility, and (4) my analysis of the hydraulic performance of the constructed facility, I hereby certify that the (1) hydrologic and hydraulic, (2) geometric, (3) public safety, (4) facility access, and (5) vegetative elements of the constructed facility are in compliance with the requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the facility.

Name: _____ Date: _____

BCE #: _____ NCPE Seal:

Geotechnical Certification

BMP Facility Name: _____

Dam Class: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction of small earth dams of a nature similar in scope to that certified to in this certification. For Class A, B, and C dams, with the exception of Class C dams that serve a detention only function and that drain an area less than 25-ac, this certification must be executed by a geotechnical engineer. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon my observation and monitoring of the construction of the dam embankment for this facility, I hereby certify that the constructed facility is in compliance with the geotechnical requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and any approved modifications.

Name: _____ Date: _____

NCPE Seal:

SECTION 4.4

BIO-RETENTION AREA AS-BUILT DRAWINGS

As-built drawings shall include plans that were approved under Section 2.1, Construction Plan Approval Process.

Use the following procedure for submitting as-built drawings (Note that all items are to be submitted electronically on a compact disc in AutoCAD format and *.pdf format):

1. Submit one (1) set of as-built drawings to the Public Works Department - Stormwater Services Division for review with the following items included:
 - a) Provide as-built grades, inverts, sizes, lengths, widths, materials, rim elevations and locations of all storm drainage structures (risers, outlet pipes, weirs/spillways, etc), details of the trash rack/surface baffle/or similar device; all elevations shall be actual elevations, not relative elevations.
 - b) Provide width and slope of grass buffer strip upstream of bioretention cell.
 - b) Provide surface area in ft² of the bioretention cell.
 - c) Provide the length and width of the bioretention cell.
 - d) Provide the elevation of the top of the mulch layer.
 - e) Provide the elevation of the top of the planting soil layer.
 - f) Provide the elevation of the top of the sand layer if applicable.
 - g) Provide the elevation of the top of the gravel jacket.
 - g) Provide the elevation of the bottom of the bioretention cell.
 - h) Provide the spacing between the perforated pipe runs.
 - i) Provide a profile through the bioretention cell and outlet structure with elevations.
 - k) Provide a plan view of the bioretention cell showing the constructed grading.
 - l) If the elevations of the outlet structures or sizes of the outlet structures differ from the approved construction drawings, a revised routing analysis shall be provided submitted on 8.5-inch by 11-inch sheets. Provide actual stage/discharge rating curves and tables on 8.5-inch by 11-inch sheets based on the surveyed information at 0.50-foot increments.
 - m) If the surveyed pond volumes are less than the approved construction drawings, a revised routing analysis shall be provided submitted on 8.5-inch by 11-inch sheets. Provide actual stage/storage rating curves and tables on 8.5-inch by 11-inch sheets based on the surveyed data at 0.50-foot increments.
 - n) Provide an as-built drainage area map that shows the drainage area draining into the stormwater control facility.
 - o) One (1) copy of the revised summary sheet for the facility based on as-built construction conditions. The summary is to be signed and sealed by an NCPE.
 - p) One (1) copy of the survey plot, including all spot shots, of the facility.
 - q) An original completed copy of the signed and sealed General Certification Inspection Checklist.
 - r) An as-built certification, as shown on the following page, signed and sealed by a North Carolina Registered Professional Engineer.
 - s) Copies of all dam embankment material composition and density testing paperwork, including a map that labels all points where the dam and dam foundation areas where tested.
 - t) Copies of all concrete compressive strength testing paperwork for any cast-in-place concrete items associated with the construction of the dam or outlet works.

- u) One (1) copy of the purchase receipt for the pipe used as the principal spillway pipe. The purchase receipt should identify the ASTM specifications governing the manufacture of the pipe.
 - v) One (1) copy of the manufacturer's certification of any armoring, other than concrete, used to armor the emergency spillway.
 - w) Colored photographs of the completed facility and of the dam foundation areas, the riser, the principal spillway pipe, the concrete cradle, the seepage diaphragm, relief drains, etc, as those items were being prepared and/or installed.
 - x) One (1) copy of Geotechnical Engineer's resume if a Geotechnical Engineer is required to provide certification.
 - y) An original signed and sealed Geotechnical Certification, as shown in the following pages.
 - z) One (1) copy of the approved Construction Drawings and Supporting Calculations, including the drainage area map, for the facility.
 - aa) One (1) copy of summary sheet for facility as presented in the Construction Drawing design documents.
 - bb) Provide a landscaping plan showing where the required plants were placed and label the type and number of all plants. Plants should match the approved construction drawings. Provide one (1) copy of the landscape company's letter certifying the installation of the specific plants required at the facility.
2. After these plans have been reviewed and approved provide one set of reproducibles (5 mm thick) double mat mylar with corrections along with marked-up set if applicable. An electronic copy of the plan is also required in *.dxf format submitted on a compact disc.

General As-Built and Construction Certification

BMP Facility Name: _____

Note 1: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction or operation of stormwater BMPs of a nature similar in scope to that certified to in this certification. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

Note 2: The certification of a bioretention area in the City of Durham does not currently require certification by a registered NC Professional Engineer certified as a BMP Certifying Engineer (BCE). It should be noted, though, that certification by a BCE may be required as the BCE program is expanded to include facilities in addition to dry ponds, wet ponds, and pocket/constructed wetlands.

CERTIFICATION STATEMENT

Based upon (1) my inspection of the constructed facility, (2) my review of the as-built survey data, (3) my review of the drainage area treated or managed by the facility, and (4) my analysis of the hydraulic performance of the constructed facility, I hereby certify that the (1) hydrologic and hydraulic, (2) geometric, (3) public safety, (4) facility access, and (5) vegetative elements of the constructed facility are in compliance with the requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the facility.

Name: _____ Date: _____

NCPE Seal:

Geotechnical Certification

BMP Facility Name: _____

Dam Class: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction of small earth dams of a nature similar in scope to that certified to in this certification. For Class A, B, and C dams, with the exception of Class C dams that serve a detention only function and that drain an area less than 25-ac, this certification must be executed by a geotechnical engineer. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon my observation and monitoring of the construction of the dam embankment for this facility, I hereby certify that the constructed facility is in compliance with the geotechnical requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and any approved modifications.

Name: _____ Date: _____

NCPE Seal:

SECTION 4.5

CONSTRUCTED AND POCKET WETLAND AS-BUILT DRAWINGS

As-built drawings shall include plans that were approved under Section 2.1, Construction Plan Approval Process.

Use the following procedure for submitting as-built drawings (Note that all items are to be submitted electronically on a compact disc in AutoCAD format and *.pdf format):

1. Submit one (1) set of as-built drawings to the Public Works Department - Stormwater Services Division for review with the following items included:
 - a) Provide as-built grades, inverts, sizes, lengths, widths, materials, rim elevations and locations of all storm drainage structures (risers, outlet pipes, weirs/spillways, etc), details of the trash rack/surface baffle/or similar device; all elevations shall be actual elevations, not relative elevations.
 - b) Provide facility bottom elevation.
Provide the water surface elevation at normal pool.
 - c) Provide the water surface area at the elevation of the normal pool in ft².
 - d) Provide the hydraulic depth at normal pool for the deep pool portion of the facility.
 - e) Provide the hydraulic depth at normal pool for the low marsh portion of the facility.
 - f) Provide the hydraulic depth at normal pool for the high marsh portion of the facility.
 - g) Provide the elevation for the start of the woody upland portion of the facility.
 - h) Provide the water surface elevation of the temporary pool.
 - i) Provide the hydraulic depth range at the temporary pool elevation for the deep pool portion of the facility.
 - j) Provide the hydraulic depth range at the temporary pool elevation for the low marsh portion of the facility.
 - k) Provide the hydraulic depth range at the temporary pool elevation for the high marsh portion of the facility.
 - l) Provide the hydraulic depth range at the temporary pool elevation for the woody upland portion of the facility.
 - m) Provide the percentage of the temporary pool surface area for the deep pool portion of the facility.
 - n) Provide the percentage of the temporary pool surface area for the low marsh portion of the facility.
 - o) Provide the percentage of the temporary pool surface area for the high marsh portion of the facility.
 - p) Provide the percentage of the temporary pool surface area for the woody upland portion of the facility.
 - q) Provide top of dam elevation with associated facility area in ft² and embankment top width. Top of dam spot elevations are required at 10-foot intervals.
 - r) Provide all side slopes (H:V) for facility embankments.
 - s) Provide a plan view of the facility showing the constructed grading.
 - t) Provide a profile through the facility and spillway with elevations.
 - u) If the elevations of the outlet structures or sizes of the outlet structures differ from the approved construction drawings, a revised routing analysis shall be provided on 8.5-inch by 11-inch sheets, based upon the surveyed information at 1.00-foot increments.
 - v) If the surveyed facility volumes are less than the approved construction drawings, a revised routing analysis shall be provided submitted on 8.5-inch by 11-inch sheets, based upon the surveyed surface areas

at 1.00-foot increments.

- w) Provide an as-built drainage area map that shows the drainage area draining into the stormwater control facility.
 - x) One (1) copy of the revised summary sheet for the facility based on as-built construction conditions. The summary is to be signed and sealed by an NCPE.
 - y) One (1) copy of the survey plot, including all spot shots, of the facility.
 - z) An original completed copy of the signed and sealed General Certification Inspection Checklist.
 - aa) An as-built certification, as shown on the following page, signed and sealed by a North Carolina Registered Professional Engineer.
 - bb) Copies of all dam embankment material composition and density testing paperwork, including a map that labels all points where the dam and dam foundation areas were tested.
 - cc) Copies of all concrete compressive strength testing paperwork for any cast-in-place concrete items associated with the construction of the dam or outlet works.
 - dd) One (1) copy of the purchase receipt for the pipe used as the principal spillway pipe. The purchase receipt should identify the ASTM specifications governing the manufacture of the pipe.
 - ee) One (1) copy of the manufacturer's certification of any armoring, other than concrete, used to armor the emergency spillway.
 - ff) Colored photographs of the constructed facility and of the dam foundation areas, the riser, the principal spillway pipe, the concrete cradle, the seepage diaphragm, relief drains, etc, as those items were being prepared and/or installed.
 - gg) One (1) copy of the Geotechnical Engineer's resume if a Geotechnical Engineer is required to provide the certification.
 - hh) An original signed and sealed Geotechnical Certification, as shown in the following pages.
 - ii) One (1) copy of the approved Construction Drawings and Supporting Calculations, including the drainage area map, for the facility.
 - jj) One (1) copy of the summary sheet for the facility as presented in the Construction Drawing design documents.
 - kk) Provide a landscaping plan showing where the required plants were placed and label the type and number of all plants. Note that the plants should match the approved construction drawings. Provide one (1) copy of the landscape company's letter certifying the installation of the specific plants required at the facility.
2. After these plans have been reviewed and approved provide one set of reproducibles (5 mm thick) double mat mylar with corrections along with marked-up set if applicable. An electronic copy of the plan is also required in *.dxf format submitted on a compact disc.

General As-Built and Construction Certification

BMP Facility Name: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction or operation of stormwater BMPs of a nature similar in scope to that certified to in this certification. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon (1) my inspection of the constructed facility, (2) my review of the as-built survey data, (3) my review of the drainage area treated or managed by the facility, and (4) my analysis of the hydraulic performance of the constructed facility, I hereby certify that the (1) hydrologic and hydraulic, (2) geometric, (3) public safety, (4) facility access, and (5) vegetative elements of the constructed facility are in compliance with the requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the facility.

Name: _____ Date: _____

BCE #: _____ NCPE Seal:

Geotechnical Certification

BMP Facility Name: _____

Dam Class: _____

Note: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction of small earth dams of a nature similar in scope to that certified to in this certification. For Class A, B, and C dams, with the exception of Class C dams that serve a detention only function and that drain an area less than 25-ac, this certification must be executed by a geotechnical engineer. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon my observation and monitoring of the construction of the dam embankment for this facility, I hereby certify that the constructed facility is in compliance with the geotechnical requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and any approved modifications.

Name: _____ Date: _____

NCPE Seal:

SECTION 4.6

UNDERGROUND DETENTION AS-BUILT DRAWINGS

As-built drawings shall include plans that were approved under Section 2.1, Construction Plan Approval Process.

Use the following procedure for submitting as-built drawings (Note that all items are to be submitted electronically on a compact disc in AutoCAD format and *.pdf format):

1. Submit one (1) set of as-built drawings to the Public Works Department - Stormwater Services Division for review with the following items included:
 - a) Provide as-built grades, inverts, sizes, lengths, widths, materials, rim elevations and locations of all storm drainage structures (risers, outlet pipes, weirs/spillways, etc), details of the trash rack/surface baffle/or similar device; all elevations shall be actual elevations, not relative elevations.
 - b) If any deviations from the approved construction drawings has occurred, a revised routing analysis shall be provided on 8.5-inch by 11-inch sheets, based upon the surveyed information at 0.50-foot increments.
 - c) Provide an as-built drainage area map that shows the drainage area draining into the stormwater control facility.
 - d) One (1) copy of the revised summary sheet for the facility based on as-built construction conditions. The summary is to be signed and sealed by an NCPE.
 - e) One (1) copy of the survey plot, including all spot shots, of the facility.
 - f) An original completed copy of the signed and sealed General Certification Inspection Checklist.
 - g) An as-built certification, as shown on the following page, signed and sealed by a North Carolina Registered Professional Engineer.
 - h) Copies of all concrete compressive strength testing paperwork for any cast-in-place concrete items associated with the construction of the facility.
 - i) One (1) copy of the purchase receipt for the pipe used for the facility. The purchase receipt should identify the ASTM specifications governing the manufacture of the pipe.
 - j) Colored photographs of the constructed facility and of the installation of the facility and all components of the facility as those items were being prepared and/or installed.
 - k) One (1) copy of the approved Construction Drawings and Supporting Calculations, including the drainage area map, for the facility.
 - l) One (1) copy of the summary sheet for the facility as presented in the Construction Drawing design documents.
2. After these plans have been reviewed and approved provide one set of reproducibles (5 mm thick) double mat mylar with corrections along with marked-up set if applicable. An electronic copy of the plan is also required in *.dxf format submitted on a compact disc.

General As-Built and Construction Certification

BMP Facility Name: _____

Note 1: This certification statement must be executed by a registered NC Professional Engineer with experience in the design and construction or operation of stormwater BMPs of a nature similar in scope to that certified to in this certification. Periodic observations of construction and a final inspection for design compliance by the certifying registered NC Professional Engineer will be required to complete this certification.

Note 2: The certification of an underground detention facility in the City of Durham does not currently require certification by a registered NC Professional Engineer certified as a BMP Certifying Engineer (BCE). It should be noted, though, that certification by a BCE may be required as the BCE program is expanded to include facilities in addition to dry ponds, wet ponds, and pocket/constructed wetlands.

CERTIFICATION STATEMENT

Based upon (1) my inspection of the constructed facility, (2) my review of the as-built survey data, (3) my review of the drainage area treated or managed by the facility, and (4) my analysis of the hydraulic performance of the constructed facility, I hereby certify that the (1) hydrologic and hydraulic, (2) geometric, (3) public safety, (4) facility access, and (5) vegetative elements of the constructed facility are in compliance with the requirements of the facility as proscribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance of the facility.

Name: _____ Date: _____

NCPE Seal:

SECTION 5.0

WATER SUPPLY/DISTRIBUTION

I. General

This section provides guidelines for the design of water main extensions for the City of Durham water distribution system. As a minimum, the Developer/Engineer shall satisfy the requirements contained herein and the City of Durham Construction and Specification Standards. See also Section 2.1, Construction Plan Approval Process.

II. Sizing Of Water Mains

A. Source

If the proposed development has 100 or more dwellings the site shall have no less than two public water main feeds serving the site. Existing mains greater than 16-inches in diameter are considered transmission mains and no connection of any kind to these mains is allowed. Developers must use mains 16-inches in diameter and less as the source location.

B. Size

1. The size of the water lines are determined by:
 - a) Fire flow plus domestic demand for the site (see also C. Pressure).
 - b) Future growth beyond the site.
 - c) Engineering Division.
2. The standard pipe diameter for public and private lines are 4-inch, 6-inch, 8-inch, 12-inch, 16-inch (refer to the City of Durham Water and Sewer Specifications). In addition, 10-inch diameters may be used for private lines.

C. Pressure

Water mains shall be sized to provide a minimum system pressure of 20-pounds per square inch (psi) during peak system demands plus fire demand. In certain areas of Durham, or for multi-story buildings, there is a potential for having lower water pressure and a private booster pump may be needed to assure adequate service to the site. If it is determined that the proposed development has a potential of being in one of these lower pressure areas, complete and submit the "Potential Low Water Pressure Acknowledgement" in Section 13.0, Forms, as directed by the City of Durham Engineering Division. If higher pressures are required or desired, it is the responsibility of the water customer to provide the necessary booster pumping equipment and facilities. If booster pumps are used contact the Engineering Division and Cross-Connection Control for requirements (back-flow, etc.). The booster pumps should be clearly noted on the construction plans if they are proposed. The peak system demands are to include:

1. The peak domestic demand plus
2. The Fire Protection System (sprinkler) demand plus
3. The fire flow demand shall be the demand for any hydrant on the project. A minimum residual pressure of 20-psi shall be available at all points in the distribution system during peak system demands. The project types and demands shall be as follows in gallons per minute (gpm):
 - a) Single family residential 1,500-gpm
 - b) Office; hotels with sprinklers;
institutional; townhomes; multifamily; or 2,000-gpm
apartment buildings (24 units or less)

- | | |
|---|-----------|
| c) Commercial with sprinklers; hotels without sprinklers; large scale multifamily apartment buildings (greater than 24 units in building) | 2,500-gpm |
| d) Commercial without sprinklers | 3,000-gpm |
| e) Industrial with sprinklers | 3,000-gpm |
| f) Industrial without sprinklers | 3,500-gpm |

Hydrant demand may also be calculated using Appendix B from the International Fire Code. A reduction of required hydrant demand is allowed when an approved sprinkler system is installed. The resulting hydrant demand (after reduction) shall not be less than 1,500 gpm.

For projects designed with more than one phase, pressure shall be checked so that these guidelines are satisfied during each phase of construction as well as after final completion of all phases.

For projects that are designed with multiple uses, the fire flow selected shall be based on the highest use allowed by zoning (i.e. – a use is set up as an office building but the zoning would allow a commercial or retail occupant to occupy the building then the requirement would be to satisfy the ultimate use of a commercial or retail occupant).

D. Fire Flow Report Requirements

If a hydrant is proposed on a project a fire flow analysis report is required to be approved by the City of Durham Engineering Division. The Engineer shall be responsible for contacting the City of Durham Engineering Division to determine the water system characteristics in the vicinity of the project. See Fire Flow Test Application in Section 13.0, Forms. The City will provide fire flow information in the vicinity of the proposed development. The Developer/Engineer shall submit information on the required fire flow and calculations in accordance with the submittals section to confirm the required fire flow is available. The fire flow analysis shall include the following:

- a) Cover sheet with project name, property identification number and PE seal and signature
- b) Summary Report should include the following:
 - 1) Location of pressure hydrant in relation to the site.
 - 2) Statement of required fire flow for the project. Briefly describe the project and indicate current zoning of the parcel.
 - 3) Statement of the following: “The (name of project) project with (required fire flow) gpm fire flow, (required peak domestic demand) gpm peak domestic flow and (sprinkler flow demand from sprinkler designer) gpm sprinkler flow provides (lowest residual pressure in system) psi residual flow at the critical node (lowest residual pressure system node). This (meets)/ (does not meet) the City of Durham fire flow requirements.
- c) Schematic drawing with pipe system layout referencing nodes and pipes. Map (to scale) of location of test hydrant (pressure) and the location of the site clearly indicated.
- d) List original water system characteristics as provided by the City noting date, location, flow hydrant, pressure hydrant and Q20 flow available.
- e) Pipe and node report indicating pipe sizes, lengths, frictions factor, minor losses and appropriate elevations and demands. Provide all references for minor loss factors and if a range is given state the value you are using. (Use C=120 for new pipes and C=110 for existing pipes)

- f) Static condition indicating only new domestic demand. (Provide all references and calculations for domestic peak demands)
- g) Separate fire flow models from each hydrant to indicate each hydrant is capable of providing the fire flow demand while concurrently providing peak domestic and fire protection system demand.

If the fire flow analysis does not meet the minimum City of Durham requirements then the consultant shall contact the City of Durham Engineering Division for further instruction, which may include additional offsite/onsite improvements.

NOTE: At the successful completion of the waterline testing phase the City of Durham Engineering Division may elect to flow test some of the hydrants to obtain data to compare against the fire flow analysis. If the flow data is inconsistent with the analysis, the design consultant and developer will be contacted to remedy the situation.

E. Water Main Material

All waterlines shall be ductile iron and services to be copper to the water meter or to the property line (meeting AWWA standards).

III. Water Main Location

A. Depth

1. Water mains shall be designed with a minimum of three feet of cover or as directed by the Engineering Division from the top of the ground to the crown of the pipe.
2. For proposed waterlines along existing roads, road centerline or edge of pavement will be required on profile in addition to the top of ground above the waterline (Cross-sections of the road from centerline of roadway to right-of-way will be required at 100-foot intervals in addition to waterline profiles). Additional cross-sections may be required depending on the project. Over long distances (greater than 1000-feet) the number of cross-sections may be reduced with the City of Durham Engineering Division approval.

B. Location

Water mains are normally located:

1. Under pavement unless approved by the City of Durham Engineering Division.
2. On the north and east sides of streets.
3. Additional waterline stubs can be required at the discretion of the City of Durham Engineering Division. At a minimum, additional stubs will be required at all intersecting roadways or rights-of - way (locations to be determined by the Engineering Division).
4. 10-feet from centerline of street (not to be under the curb and gutter section).
5. Shall be 18-inches above or 10-feet horizontal from sanitary sewer lines. If unable to maintain either of these separations both lines shall be made of ductile iron for a minimum of 10-feet beyond the crossing with the joint being centered at the point of intersection.
6. Shall be 12-inch separation from storm sewer lines and other utilities.

C. Easements, Encasements and Rights-of-Way

1. All public water mains shall be located within a street right-of-way to allow City personnel access to the main for maintenance and repair. Public water mains in easements are the exception and require special approval for use.
2. Public water main easements shall be no less than 25-feet and may be greater depending upon depth and location.

3. Private water main easements shall be no less than 25-feet and may be greater depending upon depth and location.
4. Private water lateral easements shall be no less than 15-feet and may be greater.
5. No landscaping or earthwork is allowed in existing waterline easements. No landscaping is allowed in proposed waterline easements and all earthwork must be completed before waterline is installed.
6. Encasements are required for bored crossings and railroad right-of-way. Refer to the City of Durham Water and Sewer Construction Specifications for pipe encasement details. See the table below for encasement sizes. The pipe is required to have restrained joints under the road area. The jack & bore pit size shall be shown and labeled on the construction plans. NCDOT and the railroads may have more stringent requirements.

Sizing Table for Carrier Pipes and Casing Pipes				
Nominal Carrier Pipe Size (Inches)	Steel Casing Pipe Size (Inches)			
	Railroad Crossing		Road Crossing	
	Outside Diameter	Wall Thickness	Outside Diameter	Wall Thickness
3 and Under	12.75	0.188	6.625	0.250
4	12.75	0.188	8.625	0.250
6	12.75	0.188	12.75	0.250
8	16	0.219	16	0.250
10	20	0.281	20	0.250
12	24	0.312	24	0.250
14	28	0.375	28	0.312
16	30	0.406	30	0.312
18	36	0.469	36	0.375
20	42	0.562	42	0.500
24	42	0.562	42	0.500

IV. Fire Hydrants

1. The spacing and location of fire hydrants shall meet the current provisions of the North Carolina Fire Prevention Code in addition to those provisions set forth in Items 2 through 16 below. Adequate spacing of fire hydrants shall be determined by the Fire Official. Spacing of fire hydrants around buildings and facilities shall take into account natural and man-made barriers, including steep terrain, walls, fences, waterways, culverts and vehicle parking areas. Distance measurements shall be made along the centerline of fire equipment access roadways where roadways occur.
2. Fire hydrants shall be located so that they shall be installed on a 6-inch branch line and shall be equipped with a gate valve for isolation purposes. The hydrant isolation valve shall be located directly adjacent to the water main and shall be inside the pavement when possible.
3. Hydrants shall be oriented so that large diameter connection faces fire apparatus access.
4. Hydrants shall be no closer than 10-feet from the PC or PT of any intersection, including driveways.
5. Hydrants are to be placed 18-inches to back of curb.
6. Hydrants are 1-foot within the right-of-way on strip paved streets.
7. In residential and multi-family areas:
 - a) Fire hydrants shall be located near each street intersection.
 - b) Maximum spacing of hydrants in single-family housing areas shall not exceed 500-feet. The hydrant spacing distance shall be the horizontal distance as measured along the centerline of the street.
 - c) Hydrants shall be located near the entrance of each cul-de-sac bulb where the street leading

- to the bulb is greater than 500-feet in length from the street centerline to the cul-de-sac radius point.
- d) Hydrants should be on same side as all Fire Department Connections.
8. In all commercial, business, institutional, office, shopping center, mobile home, and industrial areas:
 - a) Fire hydrants shall be located at each street intersection.
 - b) Maximum spacing between hydrants shall not exceed 500-feet. The hydrant spacing distance shall be the horizontal distance as measured along the centerline of the street.
 9. For projects designed with more than one phase, hydrants shall be located so that these guidelines are satisfied during each phase of construction as well as after final completion of all phases.
 10. Hydrants shall be situated at locations which enable fire apparatus to pass other fire apparatus which have stopped to connect to the hydrant (driveway width 20-foot minimum).
 11. A hydrant shall be installed no less than 6-feet nor more than 50-feet (lineal) from any and all Fire Department Connections (FDC). This requirement does not apply to FDC's serving the apartment buildings of group apartment housing as defined in Durham City Code Section 70-22(a)(1).
 12. Landscape plantings (when fully grown) or other vertical projections greater than 6-inches in height shall not encroach upon any fire hydrant within a 3-foot radius and not obscure view of hydrant upon approach.
 13. Hydrants should be located a minimum of 40-feet from any building walls.
 14. Hydrants shall be situated to enable fire equipment to first pass a fire hydrant before reaching any structure or hazard associated with a site.
 15. Fire hydrants located on private property adjacent to a site may be considered when an off-street access roadway of sufficient width and height between the two sites is established by an easement and approved by the Fire Official.
 16. Fire Hydrants located –
 - a) Across streets or roadways with median dividers, or
 - b) Across streets or roadways with 4 or more lanes, or
 - c) Across streets or roadways with an average daily traffic count of more than 30,000 vehicles.

From a site shall not be considered accessible and useable for purposes of this section.

V. Fire Department Connections (FDC)

- A.** These fittings, typically associated with a sprinkler/standpipe system within a building, shall be located no closer than 6-feet or greater than 50-lineal feet of a fire hydrant. In all instances, these fittings shall be located on the same side of the travel lane. Both hydrant and connection shall be accessible along the roadway fronting the building or along the roadway approaching the building. The location is subject to approval by the Fire Official. This requirement does not apply to FDC's serving the apartment buildings of group apartment housing as defined in Durham City Code Section 70-22(a)(1).
- B.** Contact Fire Department for requirements for buildings with standpipe systems.

VI. Valves

Only City personal are permitted to operate public water main valves unless other arrangements have been pre-approved by the City Engineering Division.

A. Type

1. Valves 12-inch and below require a valve box.
2. Valves 16-inch are required to be in 4-foot diameter manholes.
3. Gate valves are to be used up to and including 12-inch diameter water lines.

4. Valves controlling fire protection system water supplies, where located on private property shall be in accordance with the North Carolina Fire Prevention Code. Post indicator valves (PIV), located 40-feet from building walls when possible, shall be installed unless other valve arrangements are approved by the Fire Official.

B. Locations

1. Each intersection of water mains shall have one less main line valve than the number of intersecting pipes.
2. For all private water systems, the valves shall be located at the right-of-way line to denote public and private maintenance responsibilities.

C. Straight Runs

Main line valves located in straight runs of pipe shall be spaced as follows:

Main Size	Maximum Spacing
4-inch	400-feet
6-inch	600-feet
8-inch	900-feet
12-inch	1000-feet
16-inch	1000-feet

D. Tapping Sleeves

1. A City of Durham Engineering Division Inspector is to be present at all taps to water mains prior to the tap being made unless other arrangements have been made with the City Inspector.
2. Wet tap with a tapping sleeve and valve is permitted (refer to the City of Durham Water and Sewer Standards and Specifications).
3. Same size taps are only allowed on an 8-inch line and smaller. Any larger same size connection requires installing a tee and valve(s).
4. If a tapping valve is 12-inch or larger, the valve and the tapping sleeve are to be located within one manhole. Cut in tees with sleeves are required for 12-inch by 12-inch same size taps or larger.

E. Terminating Lines

1. For 12-inch by 16-inch taps the valve and tapping sleeve are to be located in a 5-foot diameter manhole.
2. Piping 12-inch and greater shall extend 3 pipe joints beyond end line valve.

VII. Blow-offs

Blow-offs shall be installed on all dead end mains and, as directed by the Engineering Division, at elevated points along the water main. A 1-inch blow-off assembly shall be installed on all dead end mains 8-inch or less in diameter and a 2-inch blow-off assembly shall be installed on all dead end mains greater than 8-inches in diameter. Fire hydrants are not considered as blow-offs for public lines.

VIII. Pressure-Reducing Valves

Pressure-reducing valves for water services shall be installed in accordance with current City of Durham Plumbing Code.

IX. Services and Meters

1. Two meters shall not share one service line unless one meter is for irrigation purposes. Each domestic meter shall have its own service line from the main.
2. Water meters shall be accessible to city personal at all times.
3. Water line services shall be copper or ductile iron from the main to the water meter and property line.

4. Water services shall be at right angles from the centerline of the street.
5. Meters locations shall be:
 - a) At the right-of-way line.
 - b) Just inside the right-of-way line. If sidewalk is located at the right-of-way line then the meter shall be installed at the back of sidewalk or can be installed in the sidewalk providing the water meter box top is flush, smooth and is not a tripping hazard. Extreme care shall be taken to avoid hindering the accessibility of the meter with sidewalk construction. Avoid getting concrete in or on any part of the meter box.
 - c) Easy to access with a vehicle (so a truck could back up to the meter).
 - d) Located in non-heavily landscaped areas.
6. Meters equal to or greater than 1 ½-inch shall be located in a vault with a 4-inch PVC gravity drain to daylight or drainage structure. Meters less than 1 ½-inch shall be located in a meter box.
7. Sites with city sewer that are served by wells need a city water meter installed at an accessible place for the meter reader.
8. Maximum tap sizes, allowed without a saddle, for various classes of ductile iron pipe:

Pipe Diameter	Maximum Tap Size for Class
(inches)	250/350 Pipe (inches)
4	3/4
6	3/4
8	1
10	1 ¼
12	1 ½

16-inch and larger see City Engineering for prior approval before tapping. Taps larger than those listed must utilize a saddle or approved tapping sleeve.

9. Meters shall not be installed until as-built drawings have been approved. See Section 4.0 for as-built drawing submittal requirements.

X. Water System Abandonment

A. Water Services

1. Abandonment of water services shall include excavating down to corporation, turning it off and cutting service line free from corporation. The meter, if present, shall be returned to City of Durham.

SECTION 6.0

CROSS CONNECTION CONTROL

This section is intended to provide design criteria for when a backflow preventer is required. The Water Management-Cross Connection Control office is responsible for reviewing the type of prevention assembly specified and issuing a permit. Contact Cross Connection Control at (919) 560-4194. Submit plans to City Engineering according to Section 2.1, Construction Plan Approval Process.

These guidelines are supplemental to Section .1006 (b) of the "Rules Governing Public Water Supplies". These guidelines are intended as a minimum requirement. Public water suppliers may adopt more stringent requirements. Each supplier of water shall conform to the minimum requirements established in these guidelines. **All backflow preventers located in vaults require a 4-inc PVC gravity drain to daylight or to drainage structures. No water line shall create greater than 50-feet of dead water without a backflow preventer device being installed.**

I. Degree of Hazard:

- A. Severe: Actual or potential threat of contamination that presents an imminent danger to the public health with consequence of serious illness or death.
- B. Moderate: One that presents foreseeable and significant potential for pollution, nuisance, aesthetically objectionable or other undesirable alterations of the drinking water supply.

II. Backflow Prevention Assembly Requirements:

A. Degree of Hazard:

	RPZ/RPDA	DCVA/DCDA	Air Gap
Severe	Yes	No	Yes
Moderate	No	Yes	No

RPZ=Reduced pressure zone

RPDA=Reduced pressure detector assembly

DCVA=Double check valve assembly

DCDA=Double check detector assembly

III. Guidelines for Assembly Installation in Water Distribution Systems

A. RPZ/RPDA:

1. Above ground installation.
2. 12-inches minimum clearance from vault walls and floors.

B. DCVA/DCDA:

1. Above ground installation preferred.
2. Adequate gravity drainage to daylight (no structure) shall be provided if installed below ground.

- C. RPZ /DCVA a backflow prevention assemblies shall be installed in the horizontal position.
- D. RPDA/ DCDA water meters must read in cubic feet.

IV. Facilities that Require Installation of a Backflow Preventer (this is not intended to be an exhaustive list):

A. Moderate hazard - DCVA or DCDA:

1. Fire sprinkler systems without booster pump facilities or chemical additives.
2. Connection to tanks, lines and vessels that handle non-toxic substances.
3. Lawn sprinkler systems without chemical injection or booster pumps.
4. Most commercial establishments.
5. Automotive service stations, bakeries and beauty shops with no health hazard and bottling plants with no backpressure.
6. Etc.

B. Severe hazard - RPZ, RPDA or air gap:

1. Lawn sprinkler systems with chemical injection or booster pump.
2. Wastewater treatment plants.
3. Connection to an unapproved water system or unapproved auxiliary water supply.
4. Connection to tanks, pumps, lines, steam boilers and vessels that handle sewage, lethal substances, toxic or radioactive substances.
5. Fire sprinkler systems with booster pump facilities or chemical additives or installation for buildings with five or more stories above ground level.
6. Domestic water services for buildings with five or more stories above ground level.
7. Hospitals and other medical facilities.
8. Morgues, mortuaries and autopsy facilities.
9. Metal plating facilities.
10. Bottling plants (subject to back pressure).
11. Canneries.
12. Battery manufactures.
13. Exterminators and lawn care companies.
14. Chemical processing plants.
15. Dairies.
16. Film laboratories.
17. Car wash facilities.
18. Dye works.
19. Laundries.
20. Swimming pools.
21. Water front facilities.
22. Etc.

V. Approved Backflow Prevention Assemblies:

Meets ASSE standard and carries ASSE seal or is on the University of Southern California approval list.

VI. Backflow Prevention Assembly Installation:

Backflow prevention assemblies must be located in a place where it is readily accessible for regular testing, maintenance and inspection. Bypass lines parallel to a backflow prevention assembly shall have an approved backflow prevention assembly installed that is equal to that on the main line.

SECTION 7.0

SANITARY SEWER SYSTEM

I. General

This section provides minimum guidelines for the design of sanitary sewer main extensions for the City of Durham sanitary sewer collection system. The Developer/Engineer shall satisfy the requirements contained herein. See also Section 2.1, Construction Plan Approval Process, and the City of Durham Water and Sanitary Sewer Construction Specifications.

II. Sizing Of Sanitary Sewer Mains

A. Pipe diameter

1. The size of the sanitary sewer lines are determined by:
 - a) NCDENR sizing requirements for sanitary sewer collection systems.
 - b) Future growth beyond the site.
 - c) Engineering Division.
2. Standard pipe diameter for public lines are 8-inch, 10-inch, 12-inch, 15-inch, 18-inch, 21-inch, 24-inch, 30-inch and 36-inch (refer to the Water and Sanitary Sewer Specifications).
3. A private sanitary sewer main shall be no less than 6-inches in diameter. The Engineer designing the sanitary sewer main shall sizing provide calculations (sealed and signed).
4. A sanitary sewer main is a collection system of 2 or more laterals, or as defined by the definition in Section 3.0, Permitting. A sanitary sewer permit is required for all sanitary sewer mains, and as defined by Title 15A of the North Carolina Administrative Code, Subchapter 2H.

B. Slope Requirements

Minimum slope requirements for all pipe sizes are achieved by maintaining a minimum velocity of 2.5 ft/s through the pipe when flowing half full. The minimum slope of any particular sanitary sewer main will also govern the capacity of this pipe. Maximum slopes on sanitary sewer mains are 10% unless specific approval from the Engineering Division is obtained. The Engineering reserves the right to require specific slopes as needed to insure future service and maintenance needs. Minimum slope requirements are:

- 6-inch diameter pipe - 1.00% minimum slope (private line size)
- 8-inch diameter pipe - 0.50% minimum slope
- 10-inch diameter pipe – 0.28% minimum slope
- 12-inch diameter pipe – 0.22% minimum slope
- 15-inch diameter pipe – 0.15% minimum slope
- 18-inch diameter pipe – 0.12% minimum slope
- 21-inch diameter pipe – 0.10% minimum slope
- 24-inch diameter pipe – 0.08% minimum slope

C. Sanitary Sewer Line Material

1. Standard sanitary sewer line material is to be PVC (schedule 35 for sanitary sewer mains and outfalls and schedule 40 for 4-inch and 6-inch sanitary sewer laterals) or ductile iron class 350 pressure (refer to the Water and Sanitary Sewer Specifications).
2. All sanitary sewer mains located in casing pipes shall be DIP.

No transition of materials shall be allowed except at manholes.

III. Sanitary Sewer Line Location

A. Depth

1. Sanitary sewer mains shall be designed meeting minimum depth requirements for both sanitary sewer outfalls and street mains. Sanitary sewer outfalls shall maintain a minimum depth of 4-feet from the ground elevation to the pipe crown. Sanitary sewer mains in the street require a minimum depth of 5-feet from the ground profile to the pipe crown. If a minimum depth of 3-feet cannot be met, ductile iron pipe instead of PVC sanitary sewer pipe will be required.
2. Sanitary Sewer lines greater than 20-feet deep shall be ductile iron, have a minimum of 5-foot diameter manholes and the City may require parallel and/or oversized sewer lines with wider easements.
3. Pipe tops are to be kept 2-feet below streambed flow line elevations to avoid aerial stream crossings. The pipe shall be placed to center the crossing at the midpoint between joints of the pipe (keeping the joints as far from the creek as possible).

B. Location

1. Sanitary sewer lines are normally located (unless it is an outfall):
 - a. Under pavement within the right-of-way.
 - b. On the south and west sides of streets.
 - c. In the center of the driving lane of the street.
 - d. Terminate all sanitary sewer mains with manholes.
 - e. 18-inch below or 10-feet horizontal from water lines. If unable to maintain either of these separations or sanitary sewer crosses over water both lines shall be made of ductile iron for a minimum of 10-feet to either side of crossing with midpoint of pipe being centered at the point of intersection.
 - f. With 24-inch separation from storm drainage lines.

C. Easements and Encasements

1. Where required a storm drainage pipe shall be installed across the sanitary sewer easement. The size of the pipe shall be determined using the 2-year storm event when it does not create a flooding problem. The City of Durham reserves the option to require an additional analysis based on a larger storm event and subsequent increase in storm pipe size.
2. Public sanitary sewer easements shall be no less than 30-feet and may be greater depending upon depth and location.
3. All public sanitary sewer easements shall be located in open space.
4. Private sanitary sewer main easements shall be no less than 30-feet and may be greater depending upon the depth and location.
5. Private sanitary sewer service easements shall be no less than 15-feet.
6. All sanitary sewer easements shall be drivable: Max longitudinal slope = 5:1 (H:V); Max cross slope = 10:1 (H:V).
7. Building setbacks shall be a minimum of 5-feet from all sanitary sewer easements where the depth to invert is less than 15-feet. If depth to invert is greater than 15-feet the building setback shall be a minimum of 10-feet.
8. All sanitary sewer mains shall be located within a street right-of-way or

permanent sanitary sewer main easement to allow city personnel access to the main for maintenance and repair. Approval of the sanitary sewer main extension shall be contingent upon the procurement of all necessary easements.

9. No landscaping is allowed in existing or proposed sanitary sewer easements. Earthwork may be allowed with City of Durham approval. Typical submittal shall be a plan and profile provided at the site plan stage. All earthwork must be completed before sanitary sewer is installed.
10. Encasements for mains are required for crossing NCDOT roads/streets and may be required for crossing City of Durham roads/streets. Refer to the City of Durham Water and Sewer Construction Specifications for pipe encasement details. See the table in Section 5.0, Water Supply/Distribution, for encasement sizes. NCDOT and the railroads may have more stringent requirements. The pipe is required to have restrained joints under the road area. The jack & bore pit size shall be shown and labeled on the construction plans.
11. No sediment traps, including temporary, shall be located in sanitary sewer easement or around manhole.

IV. Manholes

A. Locations

1. Manholes shall be used when sanitary sewer lines change slope or direction.
2. Manholes shall be used when sanitary sewer lines 6-inch and greater intersect.
3. Manholes shall be spaced no greater than 400-feet apart.

B. Invert and Rim Elevations

1. The maximum separation of invert in to invert out within a manhole is 0.50-feet.
2. Rim elevations along outfalls are to be a minimum of 3-feet above existing ground elevation. Depending upon the height, the City of Durham Engineering Division may require flat manholes, exterior steps and safety bars on top of manhole.
3. In flood plain areas, the 100-year flood elevation shall be noted on the drawings and the rim elevations are to be set at 2-feet above the 100-year flood elevation.
4. Along outfalls, sealed top manholes with vents may be utilized but only with the approval of the Engineering Division.

C. Drop Connections

1. Drops connections shall be outside drops (City of Durham Standards) unless approved by the City of Durham Engineering Division. The entire drop and upstream pipe shall be ductile iron.
2. Drop connections are required when the difference between invert in and invert out is greater than 0.5-feet (refer to Engineering Water and Sanitary Sewer specifications).
3. The minimum difference between the upper and lower inverts of the drop is 2-feet for 8-inch diameter sanitary sewers. Lines larger than 8-inch may require more height. The drop connections should be labeled on profile view.

D. Manhole Diameter

1. Sanitary sewer mains from 8-inches up to but not including 18-inches in diameter require manholes to be 4-feet in diameter. Sanitary sewer mains that are 18-inches in diameter and greater will require a manhole diameter determined by the Engineering Division.
2. When the depth of the manhole exceeds 20-feet (measured from the rim to invert of the manhole) the manhole shall be a minimum 5-foot diameter.
3. Larger diameter manholes, when necessary, may be required by the Engineering Division.
4. Depending on the number of lines entering the manhole and the angle of the lines entering the manhole, a larger diameter may be required by Engineering Division.

V. Sewer Taps

1. 4-inch lines should tap sewer mains instead of manholes where possible (exception would be cul-de-sacs, which must be tapped at the invert of the manhole).
2. 6-inch taps and larger will require a manhole at the sanitary sewer main.
3. Terminal manholes in cul-de-sacs are limited to a total number of 5, 4-inch diameter lateral services.
4. New taps into manholes shall be core drilled and installed with a flexible rubber boot.

VI. Anchors

1. For sanitary sewer mains less than 20% slope, there are no anchoring requirements.
2. For sanitary sewer mains greater than 20% and less than 35% slope, anchors will be required a maximum of 36-feet apart.
3. For sanitary sewer main slopes of 35% to 50%, anchors will be necessary at a maximum of 24-feet apart.
4. For sanitary sewer mains with slopes greater than 50%, anchors will be required at a maximum of 16-feet apart.

VII. Creek Crossings (Aerial)

Ductile iron lock-joint pipe will be required for all creek/river/aerial crossings. Concrete supports and/or piers may also be required depending on the depth and span of the creek/river. All aerial crossings require the pipe or casing pipe to be at least 1-foot above the 10-year flow depth and at least above the 25-year flow depth.

VIII. Services

Sanitary sewer services shall be installed according to the City of Durham standards and specifications. Standard requirements are:

1. Cleanouts every 75-feet maximum.
2. 'Y' Cleanouts shall be installed at the right-of-way line or at the sewer

easement line. Use of combinations are not permitted.

3. Whenever possible, laterals shall be perpendicular from the sanitary sewer main to the clean out at the right-of-way or the sanitary sewer easement.
4. When cleanouts are necessary in traffic areas, they shall be built according to the City of Durham details.
5. Cleanouts that are not traffic bearing are to be flush with the ground with an 18-inch by 18-inch by 4-inch concrete (3000-pounds per square inch (psi) min.) protective collar.
6. Cleanouts are to be installed according to the City of Durham details.
7. Laterals to be installed at the following minimum grade:

Lateral Size	Minimum Grade
a) 4-inch diameter	2%
b) 6-inch diameter	1%
8. Pool drain shall be tied into sanitary sewer. Discharge into pool drain must be by pumping, not gravity.
9. Carwash drain shall be tied into sanitary sewer. The drain shall be placed such that it will not collect rainwater and should be located under a roof, with the area beyond the roof sloping away from the drain. The drain line shall contain a grit separator and oil/water separator.
10. Dumpster pads for food service establishments and all establishments utilizing a compactor shall have a drain connected to the sanitary sewer. The areas beyond the dumpster/trash compactor pad shall be sloped to drain away from inlet.
11. All force mains that are covered under the plumbing code shall discharge by gravity into public lines starting at the right-of-way line.
12. Sanitary sewer connections to stubbed out services shall not be made until As-built drawings are approved.

IX. Force Mains

A. General

1. All public force mains shall be ductile iron and be sized a minimum of 2-inch diameter with a minimum design velocity of 2.5-feet per second (fps) but not greater than 10-feet per second. Plan and profile drawings are required. See the Section 2.1, Construction Plan Approval Process.
2. For private force mains, the Engineer shall submit designs to City of Durham Engineering Division (see Section 2.1, Construction Plan Approval Process) and shall also conform to requirements of the State of North Carolina. The private force main shall connect to a standard gravity service cleanout at the right-of-way or easement line.
3. All ductile iron pipe used for force mains shall be lined with *Protecto 401*, or equivalent (approval by Engineering Division required), to reduce corrosive action. This is only required where the water column separates from the pipe and creates an air pocket (at high points with air release valves).

X. Pump Stations

A. General

1. For projects involving a sanitary sewer pump station, the applicant shall contact the City Engineering Division prior to submittal of site plan or construction plans. This is to determine if the station is required or if there is a gravity option, whether or not the station will be public or private and to determine the designs that apply. The Water Management Department shall decide on types of equipment, station layout and pump operation characteristics.

B. Surface Pump station Design Checklist (Public)

1. Verbatum Modular Series SFP monitoring system (additional monitoring may be required).
2. Telephone line for telemetry required.
3. Extra contacts on starters (all pumps) with fax telemetry.
4. High level float switch for telemetry high level alarm (normally open).
5. Low level float switch for telemetry low level alarm (normally closed).
6. 8-foot high fence (including 3 strands of barbed wire).
7. 12-foot double gate w/fencing.
8. All weather drive w/turnaround outside gate.
9. Generator required.
10. Safety transfer switch for generator connection.
11. Bar screens if required (must have mechanical cleaning system).
12. Water service for wash down where water is available.
13. Backflow preventer and meter box connections for water service.
14. High alarm light/horn w/optional silencer button for horn (only if ADS system not supplied).
15. Spare parts (seals, gaskets, filters, etc.).
16. Overhead power feed is not to pass over station or drive.
17. Electrical service to be located inside fence.
18. Adequate facilities for motor and pump removal.
19. Photohelic gauge (if bubbler system is used) series 3000 Dwyer.
20. Gravel surface to extend 6-inches beyond the fence.
21. Outside pole light (wired through station breaker).
22. Pressure gauges, cocks and valves.
23. Hand rail grips for climbing down manholes or wet well.
24. Run time meters.
25. Control power transformer.
26. 3 sets of operation, maintenance, parts and electrical manuals/schematics for transformer.
27. No shared access drives.
28. Posts and chains at some drive entrances (located 30-feet from entrance).
29. Heater.
30. Blower and lights w/manual, and automatic operation with a timer switch.
31. Station must have clearance for drainage.
32. Station must have adequate working room to work on motors, pumps, valves, etc. without mechanically disassembling the housing cover.

C. Below Ground Pump Station Design Checklist (Public)

1. Sump Pump (that is in the lowest spot on floor).
2. Dehumidifier.
3. Verbatum Modular Series SFP monitoring system (additional monitoring may be required).
4. Telephone line for telemetry required.
5. Extra Contacts on starters (all pumps) for telemetry.
6. High level float switch for telemetry high level alarm (normally open).
7. Low level float switch for telemetry low level alarm (normally closed).
8. 8-foot high fence (including 3 strands of barbed wire).
9. 12-foot double gate w/fencing.
10. All weather drive w/turnaround outside gate.
11. Generator required.
12. Safety transfer switch for generator connection.
13. Bar screens if required (must have mechanical cleaning system).
14. Water service for wash down where water is available.
15. Backflow preventer and meter for connections for water service.
16. High alarm light/horn w/optional silencer button for horn (only if ADS System not required).
17. Spare Parts (seals touch-up paint, gaskets, filters, etc.).
18. Overhead power feed is not to pass over station or drive.
19. Electrical service to be located inside fence.
20. Adequate facilities for motor and pump removal.
21. Photohelic gauge (if bubbler system used) Series 3000 Dwyer.
22. Gravel surface to extend 6-inches outside fence.
23. Outside Pole Light (wired through station breaker).
24. Pressure gauges, cocks and valves.
25. Hand rail grips for climbing down manholes or wet well.
26. Run time meters.
27. Sacrificial anodes.
28. Control Power transformer.
29. 3 sets of operation, maintenance, parts and electrical manual/schematics.
30. NO shared access drives.
31. Post and chains at some drive entrances (located 30-feet from entrance).
32. Blower/Light switch which comes on automatically when entering station and with manual switch.
33. Timer for Blower when no one is in station.

XI. Sanitary Sewer Abandonment

A. Sanitary Sewer Main and Manholes

1. Abandonment of manholes shall consist of removal of manhole structures to 3-feet below finished grade, filling the manhole with concrete to an elevation of 1-foot above the crown of the pipe and filling the remaining portion with stone. The area of this removal shall be backfilled with clay

and compacted well.

When sanitary sewer mains are abandoned, 5-lineal feet of sanitary sewer nearest the sanitary sewer to remain live shall be filled with concrete.

B. Services

1. Abandonment of sanitary sewer service lines shall consist of plugging the lateral at the right-of-way line.

SECTION 8.0

STORMWATER DESIGN CRITERIA

This section is intended to provide design criteria for stormwater design of stormwater best management practice(s) (BMP(s)), open channels, culverts and pipes. All designs should be submitted as per Section 2.1, Construction Plan Approval Process and per the design summaries found in Section 8.4, Stormwater BMP Design Summaries.

I. General

Grading permits covering sedimentation and erosion control measures shall be obtained from the Durham County Soil and Erosion Control Office before construction can commence. Contact the Durham County Soil and Erosion Control Office at (919) 560-0736.

II. Runoff Calculations

Runoff calculations shall be provided for all proposed storm drainage structures including, but not limited to culverts, storm drain systems, inlets, ditches, open channels, BMPs, outlet protection, etc. and shall be sealed and signed by a registered Professional Engineer. Runoff calculations shall be provided in an 8.5-inch by 11-inch format (refer to checklists found in Section 1.2, Stormwater Services Rezoning, Site Plan and Final Plat Submittal Checklist, and Section 2.2, Construction Plan Submittal Requirements) with the exception of the drainage area maps and shall include:

A. Drainage area maps to scale. Scale shall be no smaller than 1-inch = 100-feet.

B. Mapping provided shall delineate the site area and the watershed area for proposed improvement. Copies of topographic mapping are available from the City of Durham GIS Division (919-560-4122). A USGS map may be used only if that is the best available information. The map scale, north arrow, analysis point(s), times of concentration flow paths and the drainage area for each sub-basin shall be shown. The various segments (sheet/overland, shallow concentrated and ditch/open channel/pipe flow) are to be labeled on the drainage area maps. Separate pre- and post-development maps are required for a Stormwater Impact Analysis (SIA).

C. Copy of Durham County Soil Survey, including map reference, with the site highlighted shall be provided. List all of the soils on the site and their corresponding Hydrologic Soil Group (HSG, see Table 1).

D. Runoff Coefficient Calculations (C/CN). It shall be shown in the calculations how the composite runoff coefficient was determined. Simply providing a composite runoff coefficient with no supporting documentation is not acceptable. The pre-development hydrologic condition for an undeveloped site is to be assumed in “good” hydrologic condition unless additional material is submitted supporting a different hydrologic condition.

Table 1
Hydrologic Soil Group for Soils in Durham County

Soil Abbreviation	Soil Type	Hydrologic Soil Group
AiA	Altavista	C
AiB	Altavista	C
ApB	Appling	B
ApC	Appling	B
Cc	Cartecay	C
CfB	Cecil	B
CfC	Cecil	B
CfE	Cecil	B
Ch	Chewacla	C
Cp	Congaree	B
CrB	Creedmoor	C
CrC	Creedmoor	C
DaB	Davidson	B
DaC	Davidson	B
GeB	Georgeville	B
GeC	Georgeville	B
GeD	Georgeville	B
GiE	Goldston	C
GiF	Goldston	C
GrB	Granville	B
GrC	Granville	B
Gu	Gullied Land	D
HeB	Helena	C
HeC	Helena	C
HrB	Herndon	B
HrC	Herndon	B
HsC	Herndon	B
IrB	Iredell	D
IrC	Iredell	D
IuB	Iredell	D
IuC	Iredell	D
LgB	Lignum	C
MfB	Mayodan	B
MfC	Mayodan	B
MfD	Mayodan	B
MfE	Mayodan	B
MrC	Mayodan	B
MrD	Mayodan	B
MuB	Mecklenburg	C
MuC	Mecklenburg	C
NaD	Nason	C
NaE	Nason	C
NoD	Nason	C
PfC	Pinkston	B
PfE	Pinkston	B
Ro	Roanoke	D
TaE	Tatum	C
Ur	Urban Land	D
Wh	Wahee	D
WmD	Wedowee	B
WmE	Wedowee	B
Wn	Wehadkee	D
WsB	White Store	D
WsC	White Store	D
WsE	White Store	D
WwC	White Store	D
WwE	White Store	D
WvC2	White Store	D
WvE2	White Store	D
WxE	Wilkes	C

1. Rational Formula

a. Refer to the following acceptable Rational Formula C values in Table 2 (Highway Drainage Manual, Maryland State Highway Administration, 1981 and Stormwater Design Manual, City of Raleigh, NC, 2002) that are based upon the HSG. There are no HSG A soils within Durham County. Refer to Table 1 for the appropriate HSG for the soil types within Durham County.

b. The C values in Table 2 are only acceptable for storm events less than or equal to the 10-year storm event. To correct for storm events greater than the 10-year storm event, a correction factor (multiplier) is provided in Table 3 (Municipal Storm Water Management, Debo and Reese, 1995). C value will never be greater than 1.0.

c. The Residential, Commercial and Industrial C-values can only be used for estimating the flow rates for offsite areas. For the specific project site C value, a composite C value must be developed.

Table 2
Rational Formula C Values for Storm Events Less Than or Equal to the 10-year Storm Event

Land Use	Hydrologic Condition	HSG B*	HSG C*	HSG D*
Pasture/Range	Poor	0.33	0.38	0.41
	Fair	0.25	0.33	0.37
	Good	0.20	0.29	0.34
Meadow		0.14	0.17	0.20
Wooded	Poor	0.17	0.22	0.26
	Fair	0.15	0.19	0.23
	Good	0.13	0.17	0.20
Open Space and Lawns		0.25	0.30	0.35
Paved areas, gravel and other impervious areas		0.95	0.95	0.95
Zoning				
Residential Single Family**	RU-5(2) (3,000 ft ² lots)	0.63	0.65	0.67
	RU-5 (5,000 ft ² lots)	0.51	0.54	0.57
	RS-8 (8,000 ft ² lots)	0.47	0.51	0.54
	RS-10 (10,000 ft ² lots)	0.46	0.50	0.53
	RS-15 (15,000 ft ² lots)	0.41	0.45	0.48
	RS-20 (20,000 ft ² lots)	0.34	0.39	0.43
	RR (30,000 ft ² lots)	0.30	0.33	0.35
Zoning				
Residential Multi Family**	RS-M (8 units/acre max)	0.60	0.65	0.70
	RS-M (12 units/acre max)	0.65	0.70	0.75
	RS-M (16 units/acre max)	0.70	0.75	0.80
	RU-M (20 units/acre max)	0.75	0.80	0.85
	RC	0.75	0.80	0.85
Commercial, Retail, Office, Mixed Use and Institutional**		0.80	0.85	0.90
Industrial**		0.80	0.85	0.90

* HSG refers to the Hydrologic Soil Group

** These C-values can be used only to develop flow rates for un-developed off-site areas to predict flows for culvert or bypass storm conveyance sizing.

Table 3
Frequency Correction Factors for Rational Formula C-Values

Recurrence Interval (years)	C_f
25	1.1
50	1.2
100	1.25

d. The Rational Formula cannot be used for areas more than 50 acres. In such instances, or when the limitations of the Rational Formula have been exceeded, please refer to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) method below.

e. To determine the intensity for the Rational Formula, the following equation can be used, refer to Table 4 for the values of g and h for different return periods:

$$I = g/(h+T_C)$$

I = Intensity in inches per hour

T_C = Time of Concentration in minutes (Refer to **2. b.** below to determine T_C)

Table 4
Variables for Intensity Equation

Return Period	G	H
2	132	18
5	169	21
10	195	22
25	232	23
50	261	24
100	290	25

2. USDA NRCS Hydrologic Urban Hydrology for Small Watersheds (Formerly the SCS Method)

a. For determining the curve number values, refer to the NRCS TR-55 manual recommendations, which can be found at <http://www.wcc.nrcs.usda.gov/hydro/hydro-tools-models-tr55.html>.

b. Pre- and post-developed time of concentration flow paths shall be delineated on drainage maps and shall be representative of the project site. The TR-55 segmented approach shall be used for computing times of concentration for both the pre-development and post-development condition. Assuming a time of concentration is not acceptable. Maps and calculations are to be submitted with all plans with a NCPE seal and signature. Drainage area maps shall be updated to reflect relevant existing conditions and development. The post-development sheet flow length shall be no more than 50-feet unless it can be shown that the sheet flow depth is 0.10-feet or less. Refer to Table 5 below for the appropriate Manning's n values as defined in the NRCS TR-55 manual for sheet flow. The remainder of the flow path shall be shallow concentrated or channel flow as appropriate. For discussions concerning the time of concentration flow path, the TR-55 manual can be downloaded at <http://www.wcc.nrcs.usda.gov/hydro/hydro-tools-models-tr55.html>.

c. The following rainfall amounts, provided by NOAA, shall be used in Durham:

- 1-year, 24-hour rainfall amount: 3.0-inches
- 2-year, 24-hour rainfall amount: 3.5-inches
- 5-year, 24-hour rainfall amount: 4.4-inches
- 10-year, 24-hour rainfall amount: 5.1-inches
- 25-year, 24-hour rainfall amount: 6.0-inches
- 50-year, 24-hour rainfall amount: 6.7-inches
- 100-year, 24-hour rainfall amount: 7.4-inches

Table 5
Manning's n Values for Sheet Flow (Flow Depths of < 0.10-Feet)

Surface Description	Manning's n Values
Smooth Surfaces (concrete, asphalt, gravel or bare soil)	0.011
Short Grass	0.15
Dense Grass	0.24
Woods, light underbrush	0.40
Woods, dense underbrush	0.80

III. Stormwater Layout

A. Design

1. Stormwater conveyance systems (storm drain systems, culverts and open channels) shall be sized based upon either the 10-year storm event or 25-year storm event depending upon drainage area, see Table 6 for the requirements.

The hydraulic grade line (HGL) shall not exceed the top of structures or gutter elevations as appropriate for the 25-year storm event for any storm drain system. Include the 25-year HGL calculations with storm drain sizing calculations.

HGL calculations shall take into account all head losses, friction factors and bypass flows. The downstream hydraulic gradient at the outlet end of the storm drain system shall begin at a "known" water surface elevation (as computed from backwater calculations starting at a downstream channel cross-section where the channel constricts) or shall begin at the downstream crown of the outlet of the storm drain system, whichever is greater.

In instances where the City decides to allow the 10-year HGL to exceed the crown of the pipe, all out of compliant pipe segments from one structure to another structure shall be constructed with water tight joints rated to 10-psi. In addition, the pipe shall be manufactured without lift-holes if applicable.

Inlet control calculations for culvert designs must be provided showing HW/D less than or equal to one for culverts for the design event as indicated in Table 6 or off-site improvements may be required.

Outlet control calculations for culvert designs must also be provided for culverts. The downstream hydraulic gradient at the outlet end of the culvert shall begin at a "known" water surface elevation (as computed from backwater calculations starting at a downstream channel

cross-section where the channel constricts) or shall begin at the downstream crown of the culvert, whichever is greater. These calculations must show that the HW/D is less than or equal to one for the design event.

For all non-local streets, all culverts and through drainage storm systems shall be designed to pass the 50-year storm without encroaching upon the roadway pavement. For all local streets, all culverts shall be designed to pass the 25-year storm without encroaching upon the roadway pavement. No building or habitable structure, either proposed or existing, shall be designed to be flooded or have water impounded against it during the 100-year event.

Open channel conveyance systems shall be sized with a minimum of the 10-year storm event or 25-year event as shown in Table 6 with the design storm contained within the channel banks with non-erosive velocities or suitable channel lining.

Overland relief shall be provided for all stormwater pipe systems, inlets, and culverts such that no building or habitable structure will be flooded or have water impounded against it during the 100-year storm event. 100-year storm ponding elevations, areas and overland relief zones shall be shown and labeled on the Construction Drawings. A separate grading and drainage plan sheet shall be dedicated to delineating these zones.

New development shall not create new (e.g., expanded) 100-year floodplains on previously developed or improved property or on property proposed to be improved. This requirement applies to floodplains not currently regulated by FEMA. Improvements do not include BMP facilities, drainage structures, roads, tree save areas, or open space areas. For questions concerning how this requirement is to be applied on a particular project, please contact the Stormwater Services Division at 919/560-4326.

Table 6
Design Criteria for Installation of New Stormwater Conveyance Systems

Culverts	Design Storm	Design Criteria
Drainage Basins less than 100 acres	10-year	HW/D must be less than or equal to 1 for both inlet and outlet control conditions.
Drainage Basins greater than or equal to 100 acres	25-year	HW/D must be less than or equal to 1 for both inlet and outlet control conditions.

Storm Drain Systems	Design Storm	Design Criteria
Drainage Basins less than 100 acres	10-year	HGL for the entire system is to be below crown of all pipes
Drainage Basins greater than or equal to 100 acres	25-year	HGL for the entire system is to be below crown of all pipes

Open Channels	Design Storm	Design Criteria
Drainage Basins less than 100 acres	10-year	10-year storm event must be contained within channel banks with non-erosive velocities or suitable channel lining.
Drainage Basins greater than or equal to 100 acres	25-year	25-year storm event must be contained within

2. The minimum pipe diameter shall be 15-inches. Pipe systems and culverts shall be at a one percent (1%) minimum slope. Slopes less than one percent (1%) may be accepted with the Stormwater Services Division's approval.
3. Acceptable Pipe Materials – Inside and Outside of Right-of-Way (ROW)
 - a. Reinforced Concrete Pipe, conforming to ASTM C76 (minimum Class III)
 - b. High Density Polyethylene (HDPE) pipe, conforming to AASHTO M294, Type S pipe with silt tight joints or better. Minimum diameter of 15-inches to a maximum diameter of 60-inches. HDPE pipe may be used in temporary sediment basins, but shall not be used for risers or spillway structures in BMPs.
 - c. Structural Plate Pipe (including bottomless culverts) with full bituminous coating inside and out and a paved invert, conforming to AASHTO Section 12.
 - d. Structural Plate Aluminum Pipe (including bottomless culverts), conforming to AASHTO Section 12.
 - e. Corrugated Metal Pipe (including bottomless culverts) with full bituminous coating inside and out and a paved invert, conforming to AASHTO Section 12.
 - f. Corrugated Aluminum Pipe (including bottomless culverts), conforming to AASHTO Section 12. Aluminized pipe is not acceptable.
 - g. Corrugated Steel, Aluminum Coated, Type 2 Pipe conforming to AASHTO M274 with silt tight joints or better. Allowable soil and water pH range 6.0 - 8.0 shall apply. The maximum allowable flow velocity shall be 5-fps. Resistivity shall be greater than 1500-ohm-cm. Soil shall be tested for pH value and Resistivity every 200-feet. A minimum of 2 test locations per pipe run will be required.
 - h. Ductile Iron Pipe – cement lined.

For new construction: All pipes shall be installed per Section 300, "Pipe Installation", of the North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures, January 2002 edition unless stated otherwise in the City's Standards. Backfill material used to install pipe within the street right-of-way shall be Select Material, Class I-VI, as defined by Section 1016-3 of the NCDOT Standard Specifications for Roads and Structures, January 2002 edition. Upon submittal of written certification of material suitability by a licensed geotechnical engineer, NCDOT Class I material may be used. All backfill material shall be approved by the City inspector prior to placement of material within the street right-of-way.

For repairs and utility cuts: Backfill requirements for utility (i.e., storm sewer, etc.) cuts within the right-of-way shall be bed with a minimum 4-inch of 57 stone, vibrated into place to 6-inches over the top of the pipe and backfilled to the bottom of the base course or within 12-inches of finish grade with excavatable flowable fill meeting the requirements of Section 340-2 of the NCDOT Standard Specifications for Roads and Structures, January 2002 edition. Trench width where flowable fill and stone are used for backfill shall be 1.25 X O.D. + 12-inches. Rigid pipe (concrete, ductile iron) installations may utilize flowable fill from the bedding to the bottom of the base course or within 12-inches of finished grade.

4. An overall drainage and grading plan shall be provided showing existing and proposed contours. All proposed and existing contours shall be labeled.

5. Adequate drainage controls shall be provided at all street intersections, usually upstream of the intersection. Gutter spread calculations shall be provided on all public improvements, private streets and as required by the City of Durham. Gutter spread is not to exceed ½ a travel lane for the 2-year storm event. Bypass shall be limited to less than 0.10-cubic feet per second (cfs) into an intersection for the 2-year storm event. Gutter spread Calculations shall include the following information:

- 1) All flow rates shall be provided in cfs to the nearest hundredth of a cfs.
- 2) All bypasses shall be noted. This note shall include the inlet that it will be directed to.
- 3) All bypass flows shall be accounted for in gutter spread calculations.
- 4) Half of a travel lane is calculated as half of the pavement section plus the width of the gutter (see Table 7 below). Gutter spread calculations for parallel parking are identical to the standard street section before parking was added.
- 5) Cul-de-sacs shall have a maximum spread of ½ the travel lane of the road stem of the cul-de-sac.
- 6) All gutter spread calculations shall be referenced by methodology and/or equations.
- 7) Curb inlets are not allowed within the radii of driveways or street intersections.
- 8) For sump conditions, use a 50% clogging factor to determine the inlet capacity.
- 9) Provide a table of checks for spread calculations and bypass as shown below in Table 8.

Table 7
Allowable Gutter Spread for Typical Back-Back Widths

B-B Width (feet) (24-inch Curb and Gutter)	Allowable Gutter Spread (feet)	B-B Width (feet) (30-inch Curb and Gutter)	Allowable Gutter Spread (feet)
22	6.0	23	6.5
24	6.5	25	7.0
26	7.0	27	7.5
32	8.5	33	9.0

Table 8
Example Table of Checks for Spread Calculations and Bypass

Inlet #	Bypass Inlet	Spread (feet)	Allowable Gutter Spread (feet)	Check	Bypass (cfs)
CB1	CB2	5.5	6.0	Pass	
CB2	CB3	6.1	6.0	Fail	

6. Storm drain outfalls shall be piped a minimum of 20-feet beyond the rear of any existing or proposed buildings and released to the natural drainage ditch or stream. It may be necessary to cross intervening property and obtain private drainage easements to ensure discharge into natural watercourse. All costs shall be borne by the developer. Receiving water courses shall be evaluated for adequacy (refer to Section 8.1 10% Stormwater Rule).

7. Concrete end-sections or concrete headwalls and endwalls shall be required at the beginning and end of all storm drain pipes. Storm drain pipes with a 36-inch diameter or greater will require headwalls and endwalls. If HW/D is ≥ 0.90 for any pipe with less than a 36-inch diameter, a headwall and endwall are required. An endwall is required if there is a tailwater condition at the pipe outlet such that the crown is

submerged. A headwall shall be provided at the upstream end of a pond spillway pipe unless a riser is proposed and an endwall shall be provided at the outlet of a pond spillway pipe unless a closed system outfall is proposed. Pond inlet pipes with diameters greater than or equal to 36-inch shall have concrete endwalls. Pond inlet pipes with diameters less than 36-inch shall have concrete endwalls or concrete flared end-sections. Whenever a flared end-section is proposed, a concrete curtain wall shall be provided to mitigate undermining influences. The curtain wall shall extend for the entire width of the flared end-section opening and shall extend to a depth below the bottom of adjacent riprap. Riprap or an approved alternative (permanent synthetic liners, stilling basins, level spreaders, etc) dissipation methods will be required as necessary.

HDPE flared-end-sections are not allowed.

8. Storm drain pipes are to extend to the right-of-way or beyond improvements as indicated in 6. above.
9. Storm drainage pipe and structure information table shall be listed on each sheet of construction plans and profile drawings. This information shall include pipe diameter, material, grade, inlet and outlet inverts, structure type, drainage area and flow into the pipe structure. This information should be written in a table format with corresponding pipe or structure numbers shown in plan view.
10. When drainage ditches cross sanitary sewer easements, storm drain pipes are to be installed. The pipes are to be sized to accommodate the 2-year storm event flow of the ditch. See the requirements under 1. above. The pipe shall extend the entire width of the easement.
11. Provide riprap or approved alternative outlet protection calculations for all storm drain outlets.
12. Provide open channel design calculations for all channelized storm drain flow; see requirements under 1. above.
13. All through drainage conveyance facilities shall be placed in a storm drainage easement. Through drainage shall be defined as the artificial collection and conveyance of drainage from one property (including the public right-of-way) through another property.

A yard swale will be considered a through drainage channel if and when it drains two or more upstream properties or conveys a 10-year storm event peak flow rate of 2-cfs or greater. When the above occurs, a storm drainage easement shall be provided.

14. Stormwater easements for pipes are to be calculated as follows: Width of storm drain easement equals 14-feet plus the outer diameter plus 2-feet for every 1-foot of vertical depth greater than 5-feet. The depth shall be measured from the top of the ground to the invert of the pipe. Structural encroachments into easements shall not be allowed. All storm drain lines and easements are to be located in open space as much as possible. Storm drain easements are not to be combined with other utility easements but can overlap with other utility easements. When overlapping easements are proposed, the physical utility in one easement shall not be permitted to encroach the easement of another utility.
15. Minimum building setback on all storm sewer easements shall be 2-feet.

Excessively deep storm sewers shall have an additional building setback from the easement. Storm sewers that are between 10-feet and 15-feet measured from the ground surface to the pipe invert shall have an additional building setback from the easement of 5-feet.

Storm sewers deeper than 15-feet shall have a 10-foot building setback.

In no instance shall the load plane of a building or structure come within 5-feet of the outside edge of a storm pipe.

16. Stormwater easements for channels are to be calculated as follows: Easement width equals the channel width measured from the top of bank, plus 7-feet from the top of bank on each side of the channel. Structural encroachments into easements shall not be allowed.
17. All stormwater easements shall be drivable: Max longitudinal slope = 5:1 (H:V); Max cross slope = 10:1 (H:V).

B. Stormwater Quality/Quantity Best Management Practices (BMPs)

1. Specific locations determined by the Public Works Department within a site deemed to be pollution hot spot sources will require discharge to the sanitary sewer system or adequate treatment. These locations include, but are not limited to, restaurants, fast food restaurants, any other food industry that generates food waste, automobile repair or service businesses, commercial laundry facilities such as dry cleaners and laundromats, commercial car wash businesses, etc.
2. At a minimum, Stormwater BMPs shall be designed in accordance with the Stormwater Best Management Practices Manual, N.C. Department of Environment and Natural Resources, April 1999 or latest revision and the design criteria provided in Section 8.3, Stormwater Control Facilities (BMPs), and design summaries provided in Section 8.4, Stormwater BMP Design Summaries. Provide a design summary form with design calculations for the BMPs (wet detention ponds, constructed wetlands, sand filters, underground detention structures, bio-retention areas, and dry detention ponds) with all construction drawing submittals. If a design summary does not exist for the BMP then a summary of design standards and references must be submitted. Coordination with the Stormwater Services Division is required for BMPs not covered by the design summaries or other BMP manuals.
3. Stormwater BMPs must be located on common open space in a single/multi-family project.

C. Construction

1. If RCP is used at a stream, then an 8-foot section must be used at the lower end (nearest the stream) because of possible undermining.
2. Storm drain pipes or drainage ways shall have a minimum 12-inches of cover. Inside the right-of-way, storm drain pipe shall have a minimum of 18-inches of cover from the top of the pipe to the finished grade; storm drain pipe of 60-inches in diameter or larger shall have a minimum of 24-inches of cover. When pipe is exposed to construction loads or other loads in excess of AASHTO H-20, an additional 12-inches of cover shall be provided. Pipe diameters 30-inch and larger shall be deep enough to accommodate drainage structures.
3. Storm drain pipes or drainage ways shall have at least a one-foot vertical distance from all water and sanitary lines.
4. Street catch basins shall be City standard catch basin type II or NCDOT 840.01 where applicable. Pre-cast structures may be allowed, requiring inverts to be factory cut.

5. Yard inlet catch basins shall be Type A, B, III, IV and V as shown in the City of Durham Street Construction Specifications.
6. For public streets crossed with an open-ended 24-inch diameter pipe or larger, a 4-foot high PVC coated dark green chain link fence will be required at the right-of-way for a length measured from the culvert to the end of the fill section.
7. Transition between different pipe materials shall be by a structure only, and not by a coupling.
8. 24-hour notice is required prior to beginning pipe installation.
9. Prior to burying pipe at a depth greater than 20-feet, City approval must be obtained.
10. All storm drain pipes are to be visually inspected by the City of Durham Engineering Inspectors, with an option to require the system to be videoed or mandrel tested.

D. Floodplain and FEMA Flood Zones

1. All floodplains with cross-sections and FEMA Flood Zones shall be shown on every site plan, preliminary plat, construction drawing plan and final plats. Base flood elevations and floodways shall be shown if applicable. If the floodplain is proposed to be changed, both the existing and proposed floodplain shall be shown. If a CLOMR is required, it must be obtained from FEMA before Construction Drawing approval; a LOMR must be obtained prior to the issuance of any certificate of occupancy or certificate of compliance on the project.
2. Refer to the City of Durham Unified Development Ordinance (UDO) for further information.
3. Proposed development or fill in areas currently within the base flood are required to show the lowest finished floor elevation (including duct work) and proposed grading.

SECTION 8.1

APPLICATION OF THE STORMWATER ORDINANCE

Amendment to:

Section 12.8 of the Unified Development Ordinance (UDO)

Section 8.1 of the Durham Zoning Ordinance

Section 19-5(n) of the Durham Subdivision Ordinance

Section 23-145 of the Durham City Code

Adopted by the Durham City Council on April 23, 1997

Adopted by the Durham Board of County Commissioners on February 9, 1998

Requirement (as written in the ordinance amendment)

Properties and waterways downstream from land development sites may be adversely impacted from increases in volume, velocity and peak flow rates. Any land-disturbing activity which results in an increase of impervious area may be required to provide stormwater management facilities or make other improvements to the existing drainage system to address water quantity concerns, water quality concerns, or both if the proposed development will increase potential flood damages to existing properties or significantly increase pollutant levels in downstream receiving waters.

Prior to the approval of any subdivision or site plan or the issuance of a building permit for any structure other than a single-family residence, the owner of the property proposed for development shall submit a stormwater impact analysis that complies with the requirements of the Stormwater Services Division Manager and which determines the impact of the increased stormwater runoff on downstream stormwater facilities and properties whenever the peak runoff rate from either the 2-year storm or the 10-year storm increases by more than 10% as a result of the proposed development. The Stormwater Services Division Manager shall determine the need for stormwater management facilities to address offsite impacts. Stormwater management facilities shall be designed and maintained in accordance with Section 5.5.7.2 of the Durham Zoning Ordinance and 8.7.2.D of the UDO.

Purpose

The purpose of this requirement is to assess potential flooding and water pollution impacts on existing downstream areas as a result of new development before the development occurs. It is applicable to those projects requiring zoning approval, subdivision approval or a building permit.

It should be noted that a 10% increase in runoff rates does not automatically mean that a project will be required to provide detention or make drainage improvements. It should also be noted that an increase in runoff rates less than 10% does not automatically mean that a project will not be required to provide detention or make drainage improvements.

Note: The Stormwater Services Division Manager shall have the authority to decide when and where it is in the best interests of the City to require or not require a stormwater BMP in a proposed development. In addition to, or in-lieu of, on-site management, the Stormwater Services Division Manager may, in some instances, require that an existing BMP facility be retrofitted or that downstream improvements be provided to address water quantity and/or water quality concerns.

Process

This must be performed by a North Carolina Registered Professional Engineer. The Stormwater Services Division's site plan checklist located in Section 1.2, Stormwater Services Rezoning, Site Plan and Final Plat Submittal Checklist Requirements, provides a summary of all required items.

The applicant's engineer must proceed through the following steps:

1. Use TR-55/TR-20, HEC-HMS, HEC-1 or the Rational Formula (refer to Section 8.0, Stormwater Design Criteria) to calculate the pre- and post-development discharges for each point of discharge from the site. A reduction in "overall" site imperviousness does not eliminate the requirement for an impact analysis at "every point of discharge." It would also include those projects for which a building permit had been issued and was still valid. However, individual single-family residential lots may be exempted. If runoff leaves the site at several points, the engineer must conduct a separate analysis for each point. In addition, downstream confluence points should also be checked.
2. If the post-development calculations do not show an increase greater than 10% in the pre-development 2- and 10-year peak discharges, then no further analysis is needed unless further analysis is deemed necessary by the Stormwater Services Division Manager. If the calculations show an increase greater than 10% in the pre-development discharges, then an additional downstream analysis is required.
3. A site to drainage area analysis can be used to show that the site is a small percentage of the total watershed area. Further analysis between the site and the point of analysis of the total watershed area to determine the impact of the increase in discharge is required. See the table below for percentage thresholds for using the site to drainage area analysis.

Existing Land Use	Proposed Land Use	Threshold
Unimproved	~85% impervious - (ex) commercial, business c=0.75	If the total site area as a percentage of the total watershed area at the analysis point is 2.5% or less, your analysis is complete.
Unimproved	~70% impervious - (ex) townhouses c=0.6	If the total site area as a percentage of the total watershed area at the analysis point is 3% or less, your analysis is complete.
Unimproved	~35% impervious - (ex) 1/4 acre single family homes c=0.3	If the total site area as a percentage of the total watershed area at the analysis point is 10% or less, your analysis is complete.

4. Identify the downstream point at which the increase becomes less than 10%. Further analysis is required to determine the impacts of the increase between the site and the downstream point at which the increase becomes less than 10%. Identify what is located along the drainage corridor (swales, ditches, open channels, culverts, pipe systems, etc.). If there are no negative impacts, the analysis must specifically state and demonstrate that no structures (businesses, homes, culverts, streets) will be adversely impacted by the increase in site runoff. If no structures exist between the site and analysis points, state this in the study. All negative impacts on existing improvements (e.g. streets, culverts, etc.) and development (e.g. businesses, homes, lawns, etc) must be identified. All critical sites must be analyzed. Analyses should include, but not necessarily be limited to, inlet

and outlet calculations for culverts and channel capacity calculations for drainage ways and storm drain systems.

5. Photographs must be provided for the representative downstream channel cross-sections and all culvert inlets and outlets.

6. If the downstream system is inadequate, contact the Stormwater Services Division to discuss possible improvements and/or detention requirements. If detention is required, the peak flow must be managed back to the pre-development condition.

7. Phased Developments, Expansion Projects and Re-Development Projects

a. Phased Developments

There are two options for phased projects. The first option is to have post-development calculations, on the first submittal, reflect the complete build-out conditions, thus any conveyance, detention or treatment devices would be sized for the ultimate project build-out. The second option is to have later improvements and impact studies reflect the site before any development has taken place. The earlier (previous phase) submittal will not be considered as “existing” improvements for subsequent submittals.

b. Expansion Projects and Re-Development Projects

If the existing development was built after enactment of the City of Durham 10% Stormwater Rule (4/23/97) without 2- and 10-year stormwater controls, then the existing impervious surface cannot be used as the pre-development condition. The existing and proposed impervious surface must all be accounted for in the post-development weighted runoff coefficient.

Stormwater Impact Statement Submission Requirements

The following minimum information must be submitted as part of the Stormwater Impact Analysis:

1. Stormwater Services Site Plan and Preliminary Plat Submittal Checklist found in Section 1.2, Stormwater Services Rezoning, Site Plan and Final Plat Submittal Checklist Requirements, and a Stormwater Impact Analysis signed and sealed by a registered North Carolina professional engineer.

2. A narrative report shall be provided as part of the Stormwater Impact Analysis that includes at a minimum the following:

- a. an introduction that identifies the project location, including Cape Fear or Neuse River Basin, whether or not it is in a Water Supply Watershed (F/J-A, F/J-B, E-A, E-B, M/LR-A, M/LR-B) and if so which zone, site address, a description of the pre- and post-development land cover and a general description of the proposed improvements (# of lots, parking spaces, buildings and removal of existing impervious surfaces)
- b. description of the methodologies and procedures
- c. calculations with supporting documentation
- d. summary of results including pre- and post- discharges for each drainage area
- e. conclusion detailing the findings of the drainage investigation

3. A drainage map delineating the site area and the watershed area(s) for pre- and post-development. The study area is to incorporate all downstream tributaries until it is demonstrated that the increased runoff from the developed site is no longer increasing the existing flow by more than 10%. Sub-basins must be delineated for each point of discharge for the site. Copies of topographic mapping (200/400 scale) are available from the

Department Public Works, Engineering Division. A USGS map may be used only if that is the best available information. The map scale, north arrow, analysis point(s) and time of concentration flow paths must be shown.

4. Times of concentration calculations are to be computed using the TR-55 segmented approach and shall be representative of the site. The various segments (sheet/overland, shallow concentrated and ditch/channel/pipe flow) are to be labeled on the drainage area maps. An “assumed” minimum sheet/overland flow length of 75-feet in the pre-developed condition will be accepted by the Stormwater Services Division provided that the area has not been altered such that overland sheet flow lengths would exceed 75-feet. This shall apply to flat slopes (2% or flatter) with predominantly B soil types. A maximum of 50-feet is to be used for the post-development sheet/overland flow segment unless it can be shown that the depth of sheet flow is 0.10-feet or less. Show the location of channels, ditches, swales, culverts and pipe systems analyzed on the drainage map. Digital maps are available from Technology Solutions at (560-4122).

5. A site plan or grading plan identifying the pre-development and post-development drainage patterns and imperious area coverage.

6. Calculations for the pre- and post-development discharges for the 2- and 10-year 24-hour storm using TR-55/20 HEC-1, HEC-HMS or Rational Method. Complete calculations and all supporting documentation (including but not limited to calculation of composite runoff coefficients, time of concentration (pre- and post-), ditch/open channel analysis, storm drain analysis, culvert analysis, etc.). This includes all assumptions used in the calculations and necessary channel cross-sections or pipe information used for the downstream analysis. Land use information is available from the City/County Planning Department for use in determining runoff coefficients and times of concentration. A table summarizing the pre-development and post-development peak rates with no backup information is not acceptable.

Storm Water Impact Analysis submittals that do not meet the above minimum submittal requirements will be returned without review.

See Stormwater Services Site Plan and Preliminary Plat Submittal Checklist in Section 1.2, Stormwater Services Rezoning, Site Plan and Final Plat Submittal Checklist Requirements, for submittal requirements concerning buffers (City and Neuse), floodplain, Neuse Basin (1-year storm controls and nitrogen reduction) and Water Supply Watershed requirements.

SECTION 8.2

NEUSE RIVER BASIN PERFORMANCE STANDARDS

The following information is applicable to new development in the City of Durham portion of the Neuse River Basin. For information concerning Durham County, please contact the Durham County Engineering Department at (919) 560-0735.

Under the Neuse River Basin Nutrient Sensitive Water Management Strategy, the City of Durham is one of 15 local governments required to develop and implement a stormwater management program to control nitrogen from new development. The effective date for program implementation is March 9, 2001.

For purposes of the Neuse stormwater program, new development is defined as follows:

“New development” means development within the Neuse River Basin for a project requiring site plan or subdivision approval or similar approvals by the Durham Planning Department, which, in the case of single family detached, duplex, or recreational development will result in land disturbance of greater than one acre, or in the case of other residential (including multi-family and townhomes), office, institutional, commercial, or industrial development will result in land disturbance of greater than one half acre. New development shall include re-development but shall NOT include agriculture, mining or forestry activities.

“Land disturbance” means grubbing, stump removal, removal of topsoil and coarse or fine grading, including disturbance to the subgrade.

The stormwater management program must address three elements that affect new development:

1. Limit the nitrogen export from new development to 3.6-pounds per acre per year (lbs/ac/yr)
2. Control post-development peak flow rate for the 1-year, 24-hour storm
3. Protect and maintain existing riparian buffer areas

Site Plan and Subdivision Plan Submission Requirements

Applications for new development located in the Neuse River Basin shall include the following with all site plans and subdivision plans submitted to the Durham City/County Planning Department:

1. A plan drawing showing 50-foot wide buffers immediately adjacent to all streams, lakes and water bodies that appear on EITHER the USGS 7.5 minute quad maps or the USDA SCS Soil Survey of Durham County.
2. Documentation from the NC Division of Water Quality approving any activities that impact the Neuse buffers.
3. Peak runoff calculations for the 1-year, 24-hour storm, pre-development and post-development conditions, at each drainage outlet.
4. Nitrogen loading calculations for the pre-development and post-development conditions.

5. Plans and supporting calculations showing how the nitrogen export limits and the peak runoff limits will be met. For any structural BMPs, the calculations shall include sizing and treatment design calculations.

These calculations and BMP design plans shall be submitted to the Durham City/County Planning Department with all site plan and subdivision plan applications.

6. If offset payments will be used to meet the nitrogen loading requirements, the applicant shall furnish proof that offset fees have been paid to the North Carolina Ecosystem Enhancement Program before a site plan or subdivision plan can be approved.

Development Plan Submission Requirements

Applications for development plan approval must show Neuse riparian buffers on development plan drawings and provide a conceptual plan indicating how the development can meet the nitrogen export and the peak flow requirements. If one or more structural controls will be required for either the nitrogen export or peak flow requirements, the location(s) of facility(s) shall be shown at each appropriate drainage outlet. Conceptual plans must provide enough detail to show that the plan is likely to work within the constraints of topography and space.

Controlling Post-Development Peak Runoff Rate

New development may not increase the post-development peak runoff rate from the 1-year, 24-hour storm at each point of discharge over the pre-development peak runoff rate by more than 10%.

Peak runoff calculations shall be made using the Peak Discharge Method as described in USDA Soil Conservation Service's Technical Release Number 55 (TR-55), "Urban Hydrology for Small Watersheds." For the 1-year, 24-hour storm, the rain depth to be used with this methodology is 3.0-inches.

The Rational Method cannot be used because no rainfall intensity-duration curves are available for the one-year storm in this part of the state.

New residential development is exempt from the peak runoff control requirement *IF* the impervious area does not exceed 15% impervious area and swales and other natural stormwater conveyances are used to the maximum extent practicable.

This requirement applies in the Neuse River Basin in addition to the City's existing requirements under the Stormwater Controls for Off-site Impacts Ordinance.

Application Guidelines

Peak flow will normally be evaluated at each point of discharge. Typically, the point of analysis for each discharge will be the point at which the flow enters the channel of a stream requiring a Neuse River Stream Buffer. The analysis of flow at this location may, at the discretion of the Stormwater Services Division Manager, include the flow in the Neuse River stream itself. If the stream does not border the site, the point of analysis may be taken either at the point the flow leaves the site or the point it enters the Neuse River stream.

Management of peak flow may not be required if the increase is less than 10% for that outlet. If management is provided, however, the peak flow must be managed back to the pre-development condition.

Neuse Riparian Buffers

The Neuse River Stream Buffer Rule is separate from the stormwater rule. However, the 15 local governments subject to the Neuse River Basin stormwater rule are required to ensure compliance with the Neuse River Stream Buffer regulations.

The buffer rule requires local governments to ensure that 50-foot riparian buffers on both sides of intermittent and perennial streams and around lakes, ponds and estuaries are maintained and protected from new development regardless of the amount of disturbed area for the project.

In addition to the stream buffer, a 10-foot no build setback measured from the buffer line is also required.

The applicant shall show, on subdivision and site plans of all types, 50-foot wide riparian buffers immediately adjacent to all streams, lakes and ponds appearing on either the Durham County Soil Survey maps or the USGS 7.5 minute quadrangle maps.

For intermittent and perennial streams, the buffer shall begin at the most landward limit of the top of bank and extend landward on all sides of the surface water, measured horizontally on a line perpendicular to the surface water.

For ponds, lakes, and estuaries, the buffer shall begin at the most landward limit of the normal water level and extend landward, measured horizontally on a line perpendicular to the surface water.

The applicant shall demonstrate that the new development does not impact the Neuse River Basin Stream Buffer or that the North Carolina Division of Water Quality has approved the activity that impacts the Neuse River Basin Stream Buffer.

Applicants for new development approval should note that the Neuse River Basin Stream Buffer requirements are separate from the stormwater program requirements and have different rules of applicability. Please refer to the buffer rule itself for information about the requirements to protect and preserve the Neuse River Basin riparian buffers.

A Fact Sheet on the buffer rules is appended to this guidance document. The Neuse River Basin Stream Buffer rules can be viewed at the North Carolina Division of Water Quality's website:
<http://h2o.enr.state.nc.us:80/nps/neuse.htm>.

Nitrogen Export

New development is required to limit the amount of nitrogen loading to 70% of the 1995 average non-urban nitrogen load. This is equivalent to 3.6-lbs/ac/yr of nitrogen.

The nitrogen export limit of 3.6-lbs/ac/yr can be met by using one or more of the following strategies: limit the amount of impervious area; treat stormwater runoff to reduce nitrogen; or make payment of offset fees to the North Carolina Ecosystem Enhancement Program.

Treatment

Stormwater runoff can be treated to reduce nitrogen using a variety of stormwater Best Management Practices (BMPs), including wet detention ponds, sand filters, water quality swales, buffers and constructed wetlands. Treatment methods may be used in series if greater removal rates are needed. For BMPs in series, total removal efficiency must be determined by serial calculation.

Offset Fees

Under the offset fee option, the applicant makes a one-time payment, as determined by the most recent adopted payment calculation published by the North Carolina Department of Environment and Natural Resources (NCDENR), to the North Carolina Ecosystem Enhancement Program. Offset fees are allowed for certain residential developments when the nitrogen export is between 3.6- and 6.0-lbs/ac/yr. For other developments, offset fees are permitted when the nitrogen export is between 3.6- and 10.0-lbs/ac/yr. The “certain residential developments” referenced above include the following:

- a. Single Family Detached House Construction
- b. Semi-Attached House Construction
- c. Patio House Construction
- d. Zero Lot Line House Construction
- e. Traditional House Construction
- f. Class A and Class B Manufactured House Construction (when the house resides in a Manufactured Home Subdivision (e.g. containing residential lots for sale by individual deed))

If a proposed development would generate more nitrogen, then the stormwater would have to be treated to reduce the nitrogen loading to either 6.0-lbs/ac/yr for certain residential developments or 10.0-lbs/ac/yr for other development before it would be eligible for the offset payment option.

Applicants must furnish documentation that offset fees have been paid to the North Carolina Ecosystem Enhancement Program **before** site plans and subdivisions will be approved. During the development review process the plan drawing and accompanying design and sizing calculations will be reviewed by Stormwater Services. Once the applicant has addressed all plan review comments, the applicant will be notified that the project is conditionally approved subject to receipt of proof that offset payment has been made. The conditional approval will indicate the amount of the offset payment that must be made.

Checks should be made out to the “North Carolina Ecosystem Enhancement Program.” The NC Ecosystem Enhancement Program will verify that the amount paid matches the amount specified in the conditional approval, and will send a receipt to both the applicant and the City of Durham normally within five working days, at which time the site plan drawings can be signed and released.

Check may be sent to NC Ecosystem Enhancement Program, ATTN: Christopher Mankoff, 1652 Mail Service Center, Raleigh, NC 27699-1652. The street address and phone number are as follows: NCEEP, Parker-Lincoln Building, 2728 Capital Boulevard, Suite 1H1 103, Raleigh, NC 27604; 919/715-0476.

CALCULATING NITROGEN EXPORT

Note: Most jurisdictions are using the calculation methods provided in the state’s Model Stormwater Program. The City of Durham prepared its own calculation procedure based on monitoring data that has been collected under its NPDES stormwater permit. The North Carolina Environmental Management Commission approved this methodology at its Water Quality Committee meeting on February 7, 2001.

The method requires that either the building footprints are shown or that the lot's maximum impervious area is indicated on the final plat drawings. This method may be used with any type of development. In rare cases a development will take place on agricultural land, which has higher nitrogen loadings than normal managed or unmanaged open space land. In these situations the applicant will need to determine the acreages devoted to pasture land and to cropland. For pasture a loading of 4.4-lbs/ac/yr should be used. For cropland a loading of 13.6-lbs/ac/yr should be used. Contact Stormwater Services for guidance on calculating nitrogen loading for the pre-development condition where the land is currently being used for agricultural purposes.

Method for Quantifying TN Export From Residential/Industrial/Commercial Developments

The calculations below shall be performed for both the pre-development and post-development site conditions.

Spreadsheets can be found at:

http://www.durhamnc.gov/departments/works/divisions/stormwater/design_plan_review.asp#useful

Step 1: Determine area for each type of land use and enter in Column (2).

Step 2: Total the areas for each type of land use and enter at the bottom of Column (2) at “Total Area =.”

Step 3: Calculate the fraction of the total area that is impervious area and enter in space provided Column (1).

Step 4: Using the impervious surface fraction in step 3 as “I,” calculate $(0.43 + 7.7 I)$ and enter the result in each cell of Column (4).

Step 5: For each row, multiply columns (2), (3) and (4) and enter in Column (5).

Step 6: Sum the rows of column (5) and enter at the bottom as the TN Loading.

Step 7: Divide the TN Loading calculated in Step 6 by the total area calculated in Step 2 to determine the Unit Nitrogen Loading in lbs/ac/yr.

(1) Type of Land Cover	(2) Area (acres)	(3) Land Cover Concentration Coefficient	(4) (0.43 + 7.7 I)	(5) Product of Columns (2), (3) and (4)
Impervious surface Fraction of total area: _____ = I		2.60		
Managed open space		1.36		
Undisturbed open space		0.95		
Total Area =		TN Loading (lb/yr) =		
Unit Nitrogen Loading (lbs/ac/yr) =				

Managed open space includes lawns and landscaped areas.

Undisturbed open space includes only tree save areas; tree replacement areas are considered managed open space.

SECTION 8.3

STORMWATER CONTROL FACILITIES (BMPS)

I. General

These guidelines and standards are intended to provide for the public's safety and welfare. BMPs are complex structures and must be designed and constructed with the specific site conditions, the characteristics of available construction materials, the particular functions of the facility, and the hazards associated with the site in mind. No written document can cover all design and construction problems that may be confronted by the design engineer. The general acceptability of the design and the adequacy of the plans and specifications will be determined by spot-check on a case-by-case basis. Ultimately, the responsibility for the proper design of the facility and its appurtenant structures shall rest with the design engineer of record and *not* with the City of Durham. It should be understood that, when approving construction drawings, the City of Durham takes into consideration the fact that plans were prepared, sealed, and signed by a Professional Engineer registered to practice engineering in the State of North Carolina and that the design engineer of record is wholly responsible for the content of the plans. It should be noted that City "approval" is limited and that any errors or omissions contained within an approved set of plans are Not Approved and that the developer and/or his/her representative can and may be required to address, resolve, or otherwise correct any deficiencies discovered during the life of a particular project. It should be noted further that, when required, approval of the dam design by the North Carolina Dam Safety Office will be required prior to approval by the City of Durham. In instances where any state or federal statute, requirement, or design standard is more or less stringent than that required by the City of Durham, the more stringent statute, requirement, or design standard shall apply.

The future operation and maintenance of stormwater management BMP facilities is a primary concern to the City of Durham. Engineers, in the preparation of Construction Drawings, are urged to include facility maintenance and operation as a primary design consideration.

A. Design Documents

1. The design of each stormwater BMP device shall be placed on a plan sheet dedicated solely to providing detailed design views of the device. For review and future archiving purposes, the plan view of the facility shall be at a scale of 1-inch = 30-feet or larger.
2. Hydraulic inputs and performance tables for each device shall be included with each construction drawing submittal package. In addition, all routing outputs for the operation of the facility shall be provided as well.
3. The following methods are acceptable for stormwater pond routing analyses:
 - a. Drainage areas less than or equal to 20-acres: Chainsaw Method or Storage Indication Method (i.e., TR-20, HEC-1, HEC-HMS, etc.)
 - b. Drainage areas greater than 20-acres: Storage Indication Method only

II. Stormwater Impoundments

A. Access

1. Unobstructed access from a nearby public or private right-of-way (i.e., road, parking lot, etc.) shall be provided to the top of the dam. This maintained access to the top of the dam shall be a minimum of 10-feet wide, shall have a maximum centerline grade and cross-slope of less than or equal to 5:1 (H:V) and 10:1 (H:V), respectively, and shall be placed in a 20-foot wide, cleared access easement. This access easement shall remain free of all trees, shrubs, or other obstructions, including fences, mail boxes, and utility pedestals, boxes, poles, and guy-wire systems. At curb and gutter sections, a concrete driveway entrance shall be provided. At ditch sections, a culvert and either an asphalt or concrete entrance shall be provided. The use of residential driveways for access shall not be permitted.
2. The principal access to the top of the dam and the riser structure shall not cross the emergency spillway. The City will entertain the provision of access across the control section of a separate emergency spillway provided that the access is designed as an all-weather surface capable of supporting heavy vehicles. The side slopes of the spillway shall be 5:1 or milder when the spillway is to be used for principal access.
3. In addition to the required provision of access to the top of the dam, access to the outfall, pond floor, and forebay areas shall be considered on facilities created by a Class A dam embankment.
4. Regardless of the class of dam, access shall always be provided to the inside and invert of the riser structure. This can be accomplished best with the provision of a trashrack access hatch or a manhole lid and the provision of steps down the inside face of the riser.

B. Easements

1. All facilities shall be contained entirely within a storm drainage easement. The easement shall encompass the maximum detained WSE + 10-feet and shall encompass the entire dam, outlet works, including the energy dissipation provisions and the dam's foundational areas.
2. All facilities shall be located on common open space property in single/multi-family projects. In no instance shall the easement for the facility encroach residential property. Pipe/inlet and access easements shall be excluded from this prohibition.
3. A storm drainage easement may be required from the outlet works (including the emergency spillway) of the facility to an adequate drainage feature. An adequate drainage feature shall be defined as such:
 - a. The buffer limits of a stream
 - b. The FEMA or City regulated floodplain limits of a stream
 - c. An existing channel or inlet sufficient to pass the spillway design flood without flooding a building or other habitable structure

Since the intent of this provision is to protect downstream property and to restrict future development within the area downstream of the outlet works, the limits of the inundation zone from the spillway design flood (SDF) shall be clearly defined on the plans and shall be contained completely within the aforementioned storm drainage easement. No building or habitable structure shall be permitted in the easement.

C. Dam Embankments

1. Dam Embankment Classification: Dams shall be classified in accordance with the following table:

Class	“Settled” Dam Height (feet) - Dry Ponds	“Settled” Dam Height (feet) – Wet and Extended Detention Dry Ponds
D	0 - 5 (includes excavated facilities)	
C	5+ - 10	0 – 5
B	10+ - 15	5+ - 10
A	15+	10+

2. The minimum foundation zone for an earth dam shall be determined in accordance with the following table:

Dam Class	Minimum Extent of Foundation Zone beyond the Toe of Slope, Groin, and Abutment Areas (Measured from the Dam Fill-section)
D	5-feet
C	7-feet
B	10-feet
A	10-feet

3. The planting of trees and other landscaping, except grass, on the structural embankment or foundation areas of any earth dam, which either intermittently or permanently impounds water, is prohibited. On excavated facilities, where the fill dam is 2-feet or less, this planting restriction shall be limited to only the zone over the principal spillway pipe. This zone shall be defined as either the size easement that would be required for a storm drainage pipe or 4 x the maximum depth of the pipe, whichever is greater, and shall be centered over the pipe. No new landscaping shall be permitted within the limits of the emergency spillway control section or entry or exit channels. “Existing vegetation” in the exit channel may be permitted to remain based on a case-by-case review of the specifics of the facility.
4. All plans containing an earth dam that either intermittently or permanently impounds water shall include a restrictive planting zone, which covers the entire structural embankment, including emergency spillway and exit channel, and foundation areas and which prohibits the planting of trees and all other landscaping except grass. This zone shall be clearly delineated on the Construction Drawings and shall be identified as an area to be mowed regularly.
5. The minimum dam embankment top width shall be as follows:

Dam Class	Top of Dam Width (feet)
D	8
C	10
B	10
A	12

6. All dam embankment slopes shall be at 3:1 or milder. In wet ponds, 2:1 slopes will be acceptable below the aquatic safety bench provided that a 5:1 graded access is provided to the pond floor near the riser and near the forebay.
7. All dams shall be designed to account for a 5.00% settlement factor.
8. While it is recognized that stormwater control devices will, at times, be constructed within the limits of the 1% Annual Chance Floodplain (also known as the 100-year floodplain), the downstream toe of the dam embankment fill shall be at or above the 25-year WSE. This design parameter will reduce the frequency with which flood waters could potentially erode the embankment toe. It should be noted that the placement of any dam embankment fill in an established FEMA floodway or non-encroachment area will be strictly prohibited.

D. Emergency Spillways

1. The best assurance against dam overtopping is the provision of an adequate emergency spillway. All stormwater ponds shall include an emergency spillway. The following minimum hydraulic performance parameters shall be met (Note: These performance parameters shall apply to facilities with a drainage area of 25-acres or less; facilities with greater drainage areas shall be reviewed on a case-by-case basis):

Dam Class	Spillway Design Flood (SDF)	Minimum Freeboard between the Settled Top of Dam and the Maximum Routed SDF WSE	The Crest of the Emergency Spillway Shall be Set at or above	Begin Routing Analysis at
D	25-year	0.5-feet	10-year WSE (or the 1-year WSE for 1-year Only Detention Ponds)	Crest of the Riser, Assuming that the Principal Spillway is Blocked
C	100-year	1-feet	10-year WSE (or the 1-year WSE for 1-year Only Detention Ponds)	Crest of the Riser, Assuming that the Principal Spillway is Blocked
B	100-year	1-feet	10-year WSE	Crest of the Riser, Assuming that the Principal Spillway is Blocked
A	100-year	1.5-feet	25-year WSE	Crest of the Riser, Assuming that the Principal Spillway is Blocked

2. Emergency spillways should be “cut” into existing ground. Emergency spillways constructed in fill areas shall be armored with a product approved by the City of Durham. (Note: In the past, the City has allowed the use of turf reinforcement matting on dams less than 10-feet high, where the maximum depth of fill in the emergency spillway is three-feet or less. This allowance will be periodically evaluated and may be revised accordingly by SSD.) When spillway armoring is needed, the armoring shall extend a minimum of 3-feet beyond the toe of the exit channel slope or 3-feet beyond the point where the fill in the spillway ties into existing ground. Except in the instance of a concrete spillway, certification, by the product manufacturer, of the armoring product will be required prior to as-built approval.
3. The exit channel shall be designed at a slope slightly steeper than critical slope to ensure that supercritical flow is achieved.
4. When design velocities exceed those acceptable for vegetated emergency spillways, turf armoring shall be provided. Because riprap is difficult to maintain, riprap shall not be permitted in emergency spillways. Articulated concrete block is recommended. Other armoring systems will be permitted, however, so long as such systems comply with the following criteria: (1) the armoring system must be able to withstand the SDF in terms of velocity, depth, and duration of flow; (2) the armoring system must allow a grassed surface to be achieved and that can be mowed easily, unless the armoring is a structurally reinforced concrete slab; (3) the armoring system must allow for the repeated passage of rubber-tired vehicles without damage to the system; (4) the surface of the spillway must be finished in such a manner that it discourages skate boarding and roller blading. The specifications for any turf armoring systems proposed shall be included in the design plans.
5. The exit channel for an emergency spillway shall extend out and away from a dam in a perpendicular fashion. Typically, activated discharges should not flow within 3-feet of the downstream toe of any portion of the dam embankment fill.

E. Riser Structures

1. All riser structures, including weir wall type structures, shall be reinforced concrete. Brick/concrete block and mortar type structures will not be accepted.
2. When a riser structure is not proposed, a concrete headwall shall be provided at the upstream end of the principal spillway pipe. Dry ponds with low-flow orifice diameters less than 18-inch shall include the provision of a riser structure. Restrictor plates, baffles, and pipe reducers shall not be permitted.
3. All riser structures shall be located such that direct access from the dam embankment can be achieved. Riser structures sited completely within the limits of the permanent pool will no longer be acceptable; at least one side of the riser shall be accessible by foot.
4. Open top riser structures shall include a peak-roofed trashrack with a minimum slope of 2:1. This trashrack shall include an access hatch. This hatch shall have a minimum clear space opening of at least 2-feet by 3-feet and shall align with any access steps inside the structure. Hatches can be secured with a lock and chain. Top trash racks shall be bolted to the top of the structure. Mounting the structure to the riser with bolts in shear is not recommended. Steel trash racks shall either be galvanized or primed and painted; the bolts shall be stainless steel.

5. All riser structures shall be designed to operate under outlet control.
6. Riser structures shall be evaluated for floatation resistance. A minimum factor of safety against flotation of 1.25 shall be provided at all facilities. The connection of the riser to the foundation/base shall be detailed in the construction drawings.
7. Riser structures with multiple barrel sections shall have gasketed joints, and each section shall be bolted to adjacent sections with stainless steel straps.
8. A plug-valve with a stem extension and flywheel shall be provided at all ponds with a permanent water surface. The invert of the plug valve shall be set at an elevation 12-inches above the bottom of the pond. This will allow for the preservation of a micro-pool even when the valve is completely open. An 8-inch plug-valve and emergency drain shall be the minimum size used.
9. Dry ponds with low-flow orifice diameters of less than or equal to 8-inches shall include a low-flow debris cage. The provision of a micro-pool, with a minimum depth of 18-inches, and an inverted siphon at the outlet will be an acceptable alternative.

F. Principal Spillway Pipes

1. Principal spillway pipes (PSPs) shall be a minimum of 18-inches in diameter shall be reinforced concrete and shall have a minimum pipe strength conforming to ASTM C-76, Class III. 15-inch diameter pipes will be allowed on all Class D dams and on Class C dams that have a separate emergency spillway. Gasketed joint pipe manufactured without lift-holes shall be used in all Class A, B and C dams. Low-head pressure pipe conforming to ASTM C361 shall be used on all Class A dams. Gasketed joint pipe shall also be wrapped with a double layer of non-woven filter fabric on the outside of the pipe at each joint.
2. PSPs shall be proposed at slopes of 0.7% or steeper. Slopes of 0.5% may be considered on a case-by-case basis.
3. All PSPs shall be designed to operate under outlet control.

G. Outfall Structures

1. Concrete endwalls shall be provided at the downstream end of all principal spillway pipes that outfall into an open system. Flared-end sections will not be permitted. To accommodate 3:1 grading, wing walls may also be required.
2. Non-climbable handrail shall be provided across the top of all endwalls and wingwalls where the drop from the top of the structure to the outfall channel, invert of the riser or surrounding ground exceeds 3-feet.

H. Outfalls

1. Riprap outlet protection at a minimum shall be provided at all open system outfalls. This outlet protection shall dissipate discharge velocities to non-erosive velocities. Alternative outlet protection, such as stilling basins, may also be used. Reference is made to the Federal Highway Administration (FHWA) publication HEC-14 for the design of stilling basins and energy dissipaters. Also, publications by the Natural Resources Conservation Service, the Bureau of Reclamation and the Army Corp of Engineers can be referenced for stilling basin design. In all

cases, the riprap size selected must be able to withstand anticipated maximum discharge velocities. The depth of riprap placement shall be 2 times the D_{50} size of the riprap and the length of the riprap shall be at least 15 times the anticipated depth of scour. In no case, shall the length of riprap be less than four times the diameter or height of the principal spillway pipe.

2. All level spreader devices should be designed and installed in accordance with DWQ guidelines. Other level spreader designs may be accepted on a case-by-case basis. A detail of the level spreader device shall always be provided on the Construction Drawings for the project.

I. Inlets

1. Pond inlet pipes greater than 30-inches in diameter shall have concrete endwalls. To accommodate 3:1 grading, wing walls may also be required. Non-climbable handrail shall be provided across the top of all endwalls and wing walls where the drop from the top of the structure to the outfall channel, invert of the riser or surrounding ground exceeds 3-feet.
2. Pond inlet pipes of 30-inches in diameter or less shall be either concrete endwalls or concrete flared end-sections. Whenever a flared end-section is proposed, a concrete curtain wall shall be provided to mitigate underming influences. The curtain wall shall extend for the entire width of the flared end-section opening and shall extend to a depth that is at least at the bottom of any adjacent riprap.
3. Pond inlet pipes that experience pressure pipe conditions (e.g., the 10-year HGL exceeds the crown of the pipe) shall be constructed with gasketed joint pipe, meet the ASTM C361 Standard and shall be manufactured without lift holes. Whenever gasketed joint pipe is used, it shall be wrapped with a double layer of non-woven filter fabric on the outside of the pipe at each joint. The fabric wrap shall cover a two-foot length of pipe and shall be centered over the joint.

J. Impoundment Areas

1. All wet ponds and constructed wetlands shall include a forebay. The volume of the forebay shall be approximately 20% of the permanent pool volume. Pocket wetlands and dry detention basins shall include riprap lined sediment basins at each inlet. All inlets to a wet pond or a constructed wetland shall discharge into the forebay for the facility.
2. For both safety and water quality reasons, a 10-foot wide aquatic shelf shall be provided at the shoreline of all wet ponds. This aquatic bench shall, at the outer limits (e.g., the shoreline), begin at a depth of 4-inches below the surface of the permanent pool and shall be graded at a 6:1 slope such that a 2-foot depth is provided at the inner limits of the bench. Since a wetland type environment is desired, wetland vegetation for the aquatic bench shall be included in the vegetation plan for the facility.
3. For constructed and pocket wetlands, there are, essentially, four environmental zones in a wetland: the deep pool zone, the low marsh zone, the high marsh zone and the woody upland zone. Provided below is a tabulation of these four zones:

Zone	Water Depth Range at Normal Pool	Water Depth Range at Temporary Pool (Note: The Temporary Pool Should Be	Portion of Temporary Pool Surface Area
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		between 0-inches and 12-inches above the Normal Pool)	
Deep Pool	18-inches to 36-inches	18-inches to 48-inches	10% – 20%
Low Marsh	3-inches to 6-inches	3-inches to 18-inches	40% – 60%
High Marsh	0-inches to 3-inches	0-inches to 15-inches	10% – 20%
Woody Upland	n/a	0-inches to 12-inches	Remaining %

4. The maximum depth of the temporary water quality pool (designed to drawdown in 2-5 days) in constructed wetlands and pocket wetlands should not exceed 12-inches above the permanent pool surface. This pool depth restriction should reduce the suffocating effects of the temporary pool on the wetland vegetation.
5. Deep pool depths in constructed wetlands and pocket wetlands shall be 18- to 36-inches. To discourage the flocking of nuisance water fowl, multiple deep pool areas, as opposed to just one area, are recommended.
6. Forebay berms shall be constructed with an armored spillway. The top of the berm shall be above the surface of the permanent pool and shall be planted with trees, shrubs, and vegetation conducive to a wetland/wet meadow environment.
7. Except along the shoreline of the dam embankment, at pipe inlets and at the access points to the dam and the forebay/sediment basins for the facility, a 15-foot wide riparian buffer shall be established around the perimeter of each wet pond, constructed wetland, and pocket wetland. This buffer, once planted with wetland, wet meadow, and woody upland types of vegetation, should be allowed to return to a natural state (Note: No woody vegetation shall be permitted to be planted within the upstream foundation area of the dam embankment fill). Mowing in these areas should, typically, not be permitted. This zone shall be clearly delineated on the Construction Drawings and the planting of these areas shall be included in the vegetation plan for the facility.
8. When calculating the depth of the wet pond, the hydraulic depth shall be used. The hydraulic depth is the volume of the pond divided by the surface area of the pond.
9. Wet pond length to width ratios shall be greater than or equal to 3:1 at the permanent pool.
10. Constructed and pocket wetland low-flow length to pond width ratios shall be greater than or equal to 3:1 at the permanent pool.
11. Dry pond floors shall be graded irregularly and shall be seeded with a wet meadow or wetland seed mixture. Once vegetation is established, the pond floor should remain unmowed. This “No Mow” zone shall be clearly delineated on the construction drawings. Note: The upstream foundation area of the dam should only be seeded with grass and it should be mowed regularly. It is recommended that a micro-pool of at least 12-inches deep be provided in front of the riser to promote an even greater wetland type environment.
12. The foundation for a keystone retaining wall shall be at or above the 2-year WSE in the pond.
13. Non-climbable handrail shall be provided across the top of any retaining wall installed within the pond easement limits where the drop from the top of the structure to surrounding ground exceeds 3-feet.

14. Pond side slopes above the pond floor shall be no steeper than 3:1, with the exception of the following: 2:1 slopes will be allowed below the aquatic safety bench in wet ponds so long as a 5:1 graded access is provided to the pond floor in the vicinity of the riser and in the vicinity of the forebay.

K. Dam Embankment Construction Standards

1. Controlled fill, as specified by the Geotechnical Engineer, in the dam embankment shall be placed in 6-inch loose layers (3-inc loose layers within 3-feet of either side of the principal spillway pipe to a depth of 2-feet over the pipe) and shall be compacted to a density of no less than 95% of the Standard Proctor Maximum Density at a moisture content of + or – two percentage points of the optimum moisture content in accordance with ASTM D698.
2. All visible organic debris such as roots and limbs shall be removed from the fill material prior to compaction to the required density. Soils with organic matter content exceeding 5% by weight shall not be used. Stones greater than 3-inch (in any direction) shall be removed from the fill prior to compaction.
3. Fill material placed at densities lower than specified minimum densities or at moisture contents outside the specified ranges or otherwise not conforming to specified requirements shall be removed and replaced with acceptable materials.
4. Any fill layer that is smooth drum rolled to reduce moisture penetration during a storm event shall be properly scarified prior to the placement of the next soil lift.
5. Surface water and stream flow shall be continuously controlled throughout construction and the placement of controlled fill.
6. Foundation areas may require undercutting of compressible and/or unsuitable soils in addition to that indicated on the plans. All such undercutting shall be performed at the discretion of the geotechnical engineer and shall be monitored and documented. In no case shall there be an attempt to stabilize any portions of the foundation soils with crushed stone.
7. Treatment of seepage areas, subgrade preparation, foundation dewatering and rock foundation preparation (i.e., treatment with slush grouting, dental concrete, etc.) may be required at the discretion of the geotechnical engineer. All such activities shall be closely monitored and documented by the geotechnical engineer.
8. Fill adjacent to the riser and principal spillway pipe shall be placed so that lifts are at the same level on both sides of the structures.
9. Earthwork compaction within 3-feet of any structures shall be accomplished by means of hand tampers, manually directed power tampers or plate compactors or miniature self-propelled rollers.
10. Compaction by means of drop weights from a crane or hoist shall not be permitted.
11. Heavy equipment shall not be allowed to pass over cast-in-place structures (including the cradle) until adequate curing time has elapsed.
12. To re-establish vegetation after construction, a 2- to 3-inch layer of topsoil shall be placed on the disturbed embankment surface and the area seeded and mulched or hydroseeded.

L. Seepage Control Standards

1. Anti-seep collars are no longer acceptable for use in the City of Durham.
2. Seepage control measures shall be considered in the design of all dam embankments. The following table specifies the minimum measures that shall be included in the design of dam embankments as well as those control measures that should be considered in the design:

Dam Class	Cradle	Cut-off Trench ¹	Seepage Diaphragm or Drainage Blanket around PSP	Toe Drains	Clay Core (Zoned Dam)
D					
C	Considered	Considered	Considered		
B	Required	Required	Required	Considered	Considered
A	Required	Required	Required	Considered	Considered

Note 1: The depth of the cut-off trench shall be based on the depth recommendations provided by the Geotechnical engineer as determined from soil boring logs provided along the axis of the proposed dam embankment.

3. Because the contact between an embankment penetrating conduit and the soil in the embankment is the area most susceptible to piping (e.g., internal erosion of embankment soil), special attention must be given to the design of the principal spillway pipe. Depending on the dam height and facility type (e.g., a wet pond vs. a dry pond), the installation of concrete cradles and seepage collection and filtration media shall be considered and, in some instances, provided. These considerations should be evaluated formally by a qualified geotechnical engineer, who is registered as a Professional Engineer in the State of North Carolina. The geotechnical engineer must have experience in the design and construction of small earth dams. All internal drainage designs shall be prepared and sealed by a geotechnical engineer.
4. Utility conduits other than the principal spillway pipe shall not be permitted to penetrate the embankment or the embankment foundation. These utility conduits shall be routed around the embankment and foundation areas.
5. Concrete in the cradle shall have a 28-day compressive strength of 4,000-psi and shall be placed on a 2- to 2.5-inch slump. A slump test shall be performed prior to placement and compressive strength tests shall also be performed to ensure compliance with these specifications. The concrete cradle shall be placed monolithically, shall be worked with hand equipment up under the principal spillway pipe, shall be consolidated primarily by internal vibration and shall be finished “rough” so as to achieve a more adequate bond between the concrete in the cradle and the first lift of structural fill. Cradles constructed of flowable fills, slurries or gels will not be permitted.
6. Dam embankments without internal drainage shall not be permitted for wet ponds where the phreatic surface of the dam is anticipated to intersect the downstream face of the dam during normal pool conditions.
7. Filters shall be designed to prevent the migration of fines from the foundation or embankment soils into the internal seepage collection devices (e.g., diaphragms, chimney drains, toe drains, etc.). In wet ponds, where the normal pool “head” at the dam is greater than 6-feet (measured from the elevation of the normal pool to the invert of the outfall), a sand layer shall be provided

upstream of the seepage collection media. In all other applications, non-woven geosynthetic fabrics may be used.

8. The sand filter blanket shall be a minimum of 18-inches thick and shall be designed to stabilize the migration of embankment soils into the filter.

M. Testing, Observation, and Certification

1. Tests of the degree (%) of compaction of the placed fill in the dam shall be performed as a part of the permittee's normal quality control program for the construction of the dam. Tests shall be conducted concurrent with the installation of the compacted fill and the contractor shall coordinate the construction of the dam so that the testing can be completed. Should the results of the tests indicate that the specified degree of compaction has not been obtained; the portions of the dam represented by such tests shall be reworked or rebuilt. All portions of the dam shall achieve the specified minimum degree of compaction.
2. Construction of Class A, B and C dam embankments shall be done under the observation of a qualified geotechnical engineer, who is registered as a Professional Engineer in the State of North Carolina. The geotechnical engineer must have experience in the design and construction monitoring of dams of the size and scope covered by these standards and guidelines.
3. On Class A, B, and C dams (with the exception of detention only Class C dams that collect drainage from an area of 25-acres or less), the geotechnical engineer, as defined above, shall observe all aspects of the construction of the dam (i.e., preparation of the foundation, installation of the cut-off trench, installation of the principal spillway pipe, installation of the internal drainage, installation of compacted fill, etc.). The frequency of observation and testing must be sufficient for the geotechnical engineer (or the design engineer on Class D dams and Class C, detention only, dams) to state, in his/her professional opinion, that the specific items observed and tested were installed in accordance with the approved construction drawings and specifications. Reference is made to Sections 4.1 to 4.5 regarding geotechnical certification of dam embankments.

III. Underground Detention Systems

A. System Requirements

1. An underground detention system shall, at a minimum) consist of two 60-inch minimum diameter header pipes and two 60-inch minimum diameter perimeter pipes. 36-inch minimum diameter interior storage pipes shall be provided when interior storage pipes are needed.
2. At a minimum, manhole access shall be provided at the 4 corners of the system. All access manholes shall be reinforced concrete manholes conforming to NCDOT Roadway Standards.
3. Spacing of the storage pipes shall be to manufacturer specifications.
4. Traffic bearing cleanouts shall be provided at 100-foot intervals, with a minimum of two provided in each pipe run. Manhole access structures may be counted as cleanouts.
5. A traffic bearing bilco door (or approved equivalent) shall be placed at the inlet to the underground system and at the control structure for the underground detention system.

6. Backfill material shall be certified by a Geotechnical Engineer.
7. The system shall remain water tight for the 10-year hydrostatic pressure calculated at the inlet to the underground detention system.
8. Straight line systems will be considered as an alternate to the two-header/perimeter system.
9. A surface or sub-surface bypass is to be sized to safely convey the 100-year, 24-hour post-development storm event or the maximum storm depending upon road classification as stated in Section 8.0, Stormwater Design Criteria, whichever is applicable.
10. The underground detention system shall be fully maintainable. An operation and maintenance plan is to be provided and shall include the following:
 - a. Provision for sediment and debris removal (including large items that cannot be vacuumed from the system such as sticks, rocks, etc.)
 - b. Provision for sediment and debris removal
 - c. Proposed inspection and cleanout schedule
 - d. Recommended maximum sediment depth prior to mandatory maintenance

IV. Sand Filters

1. The sand layer shall be a clean ASTM C-33 medium aggregate sand with a size range of 0.02-inch to 0.04-inch.

V. Bioretention Areas

1. The drainage area to a bioretention cell shall be limited to one acre or less.
2. Pre-treatment shall be provided at each inlet. A small sediment basin at each inlet is recommended.
3. The mulch layer shall be a course shredded hardwood.
4. The soil mix shall have a P-Index of 25 or less.
5. The clay content in the bioretention soil mix shall be 8% or less.
6. Consideration for allowing a 6-inch to 12-inch saturated zone in the bottom of the bioretention area is currently under evaluation. Installing such a zone will require an additional 6-inch to 12-inch of excavation below the facility.

VI. Bioretention Area Plant Lists

Bioretention beds present a unique and difficult set of plant growing conditions. While many plants can be grown on the higher edges of bioretention beds, very few plants can tolerate the periodic flooding that occurs in low zones (e.g., in the bed bottoms. Any plants planted in the low zones should be planted “high” on slightly raised mounds to facilitate aeration of the roots. Keep in mind the mature size of plants when placing them in a bioretention bed, remembering that adequate open space should be planned for in the mature bed for mulch renewal, trash pick up, and sediment removal.

Trees for Bioretention Low Zone

(Note: Typically, trees should not be planted in within 10-feet of a relief drain or in areas where tree shading might adversely affect low-growing vegetation.):

- a. Red Maple (*Acer Rubrum*)
- b. River Birch (*Betula Nigra*)
- c. Bald Cypress (*Taxodium sp.*)
- d. Gums and Tupelo (*Nyssa sp.*)
- e. Hawthorn (*Crataegus Phanoepyrum*)

Shrubs for Bioretention Low Zones:

- a. Button Bush (*Cephalanthus Occidentalis*)
- b. Sweetspire (*Itea sp.*)
- c. Inkberry (*Ilex Glabra*)

Trees for Bioretention High Zones:

- a. Ash (*Fraxinus sp.*)
- b. Maple (*Acer sp.*)
- c. Loblolly pine (*Pinus Taeda*)
- d. Oak (*Quercus sp.*)
- e. Willow (*Salix sp.*)

Shrubs for Bioretention High Zones:

- a. Pepperbush (*Clethra Alnifolia*)
- b. Ti-ti (*Cyrilla Racemaflora*)
- c. Inkberry (*Ilex Glabra*)
- d. Yaupon Holly (*Ilex Vomitoria*)
- e. Dwarf Yaupon Holly (*Ilex Vomitoria*)
- f. Sweetspire (*Itea sp.*)
- g. Deciduous Holly (*Ilex Decidua*)
- h. Wax Myrtle (*Myrica Cerifera*)
- i. Winterberry (*Ilex Verticillata*)

VII. Stormwater Wetland Plant Lists

1. Stormwater wetlands (constructed and pocket wetlands) are designed to retain and improve the quality of stormwater runoff. To fulfill the water retention function, the temptation is to design stormwater wetlands with excessive storage areas with deep water, preventing the establishment of emergent herbaceous species which can best slow and treat stormwater runoff. Many emergent species will perform well in 3-inches to 6-inches of water. To encourage colonization by native annual and perennial wetland species, a small quantity of soil can be collected from nearby natural wetlands and distributed over the constructed wetland.
2. Cattails (*Typha sp.*) can be introduced with seed banks or by natural means and can quickly choke out the other vegetation in the wetland. Cattails can be controlled in the early phases of colonization by wiping with aquatic formulations of the systemic herbicide glyphosate. To maintain a stormwater wetland in a dense, herbaceous, vegetative state, avoid planting or control large shrubs or trees that could shade out herbaceous species.
3. Below are acceptable plant lists for use in Stormwater Wetlands broken out by wetland zone:

Wetland Emergent Herbaceous Species (3-inches to 12-Inches of Water):

- a. Pickerel Weed (*Pontederia Cordata*)
- b. Duck Potato (*Sagittari Latifolia*)
- c. Arrow Arum (*Peltandra Virginica*)
- d. Bulrush (*Scirpus sp.*)
- e. Rush (*Juncus sp.*)
- f. Sedges (*Carex sp.*)
- g. Woolgrass (*Scirpus Cyperinus*)
- h. Blue Flag Iris (*Iris Virginiana*)
- i. Lizard's Tail (*Saururus Cernus*)
- j. Buttonbush (*Cephalanthus Occidentalis*)

Wetland Shallow Land Species:

- a. Cardinal Flower (*Lobelia Cardinalis*)
- b. Marsh Mallow (*Hibiscus sp.*)
- c. Swamp Milkweed (*Asclepias Incarnate*)
- d. Inkberry (*Ilex Glabra*)
- e. Sweet Pepperbush (*Clethra Alnifolia*)
- f. Virginia Sweetspire (*Itea Virginica*)

Floating Species for Deep Pools and Forebays:

- a. American Lotus (*Nelumbo Lutea*)
- b. Water Lily (*Nymphaea Odorata*)
- c. Cow Lily (*Nuphar Luteum*)

VIII. BMP Efficiency Rates

Table 1
BMP Types, TN Removal Rates and Design Standards

BMP Type	Approved TN Removal Efficiency	Approved TP Removal Efficiency	Approved TSS Removal Efficiency²
Wet Detention Pond	25%	40%	85%
Extended Detention Wetland	40%	35%	85%
Pocket Wetland	40 ³	35% ³	35%
Extended Detention Dry Pond	10% ³	10%	50%
Grassed Swale	20% ³	20%	35%
Riparian Buffer (50-foot Restored Riparian Buffer with Level Spreader)	30%	30%	85%
Vegetated Filter Strip with Level Spreader	20%	35%	25-40%
Bio-Retention Area ¹	35%	45%	85%
Sand Filters ¹	35%	45%	85%
Proprietary BMPs	Varies ³	Varies ³	Varies ³

¹ City of Durham allows the use of a sand filter and bio-retention area BMP only where the area draining to it is nearly all impervious (90% impervious or greater). Runoff from pervious areas shall be directed away from the sand filter and bio-retention area.

² TSS removal rates are provided for convenience of reader. BMPs may also be required to meet water supply watershed requirements, which requires minimum overall 85% removal rate for TSS.

³ Requires NC DWQ's approval in addition to the City of Durham's approval.

If BMPs are installed in series on a development site, the overall removal rate shall be determined through serial, rather than additive, calculations.

Example: A water quality swale (open channel practice) is used upstream of a wet detention pond. The respective removal rates for total nitrogen are 20% and 25%. The swale removes 20%. The wet detention pond would then treat the remaining 80% of N that was not removed in the swale. The detention pond removes:

$$80\% \times 25\% \text{ efficiency} = 20\% \text{ removed}$$

The total nitrogen removal for these BMPs in series is $20\% + 20\% = \underline{40\%}$.

This table may be revised periodically as new BMPs are developed and BMP efficiency studies are completed.

SECTION 8.4

STORMWATER BMP DESIGN SUMMARIES



City of Durham

Public Works Department

Stormwater Services Divisions

101 City Hall Plaza, Durham, North Carolina, 27701
Telephone (919) 560-4326 FAX (919) 560-4316

Dry Detention Basin Design Summary

Stormwater Management Construction Plan Review:

A complete stormwater management construction plan submittal includes a design summary for each stormwater BMP, design calculations, plans and specifications showing BMP, inlet and outlet structure details.

I. PROJECT INFORMATION

Project Name: _____ Phase _____

PIN: _____ Case #: _____

Design Contact Person: _____ Phone #: (____) ____ - _____

Legal Name of Owner: _____

Owner Contact: _____ Phone #: (____) ____ - _____

Owner Address: _____

Deed Book _____ Page # _____ or Plat Book _____ Page# _____ for BMP Property

For projects with multiple basins, specify which pond this worksheet applies to: _____

Detention provided for: _____ 1-year _____ 2-year _____ 10-year _____ other _____

Dam Height: _____ (feet) Dam Classification: _____

Elevations

Basin bottom elevation	_____	ft. (floor of the pond)
1-year storm orifice/weir elevation	_____	ft. (invert elevation)
1-year storm water surface elevation	_____	ft.
2-year storm orifice/weir elevation	_____	ft. (invert elevation)
2-year storm water surface elevation	_____	ft.
10-year storm orifice/weir elevation	_____	ft. (invert elevation)
10-year storm water surface elevation	_____	ft.
Emergency spillway elevation	_____	ft. (invert of emergency spillway)
Top of embankment/dam	_____	ft. (elevation)
Maximum water surface elevation	_____	ft. (max. storm pond can safely pass)

Areas

Design storm surface area	_____	ft ² (Specify frequency event: _____ year)
Drainage area	_____	ac. (total drainage to the pond)

Volumes

Total storage volume provided at design storm	_____	ft ³
Total storage volume provided at top of dam	_____	ft ³

Hydraulic Depth (volume of design storm divided by surface area of design storm)

Hydraulic Depth _____ ft.

Discharges (Specify only applicable frequency events)

At BMP

	1-year	2-year	10-year	____-year
Inflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Routed outflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs

At Analysis Point(s) that BMP Contributes to

	1-year	2-year	10-year	____-year
Pre-development	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Post-development w/o detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs
With detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs

Riser/Principal and Emergency Spillway Information

1-year storm orifice/weir	diameter_____ in.	length _____ft.
2-year storm orifice/weir	diameter_____ in.	length _____ft.
10-year storm orifice/weir	diameter_____ in.	length _____ft.
____- year storm orifice/weir	diameter_____ in.	length _____ft.
Principal spillway	diameter_____ in.	
Emergency spillway	width_____ ft.	side slopes ____:1 slope_____%

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines design requirements. In the space provided to indicate the following design requirements have been met and supporting documentation is attached.

Applicant's initials

- _____ a. Riprap outlet protection, if provided, reduces flow to non-erosive velocities (provide calculations).
- _____ b. The basin side slopes are no steeper than 3:1.
- _____ c. Vegetative cover for the basin is specified. No woody vegetation is permitted on the embankment.
- _____ d. A trash rack or similar device is provided for both the overflow and orifice. Flat top trash racks are not acceptable. Access hatch has been provided.
- _____ e. A recorded drainage easement is provided for each basin including access to the nearest right-of-way and is graded per Section 8.3, Stormwater Control Facilities (BMPs).
- _____ f. If the basin is used for sediment and erosion control during construction, a note requiring clean out and vegetative cover being established prior to use as a dry detention basin shall be provided on the construction plan.
- _____ g. Anti-floatation calculations are provided for riser structure.
- _____ h. A plan view of the pond with grading shown is provided.
- _____ i. A profile through the forebay, main pond and spillway is provided. Water surface elevations are shown on the profile.
- _____ j. Riser structure details are provided.
- _____ k. Compaction specifications for the embankment are provided on the plan.
- _____ l. Dam designed to account for a 5.00% settlement factor.

_____ m. The minimum top of dam width has been provided for the pond embankment top width per Section 8.3, Stormwater Control Facilities (BMPs).

Note: Executed Stormwater Facility Operation and Maintenance Permit Agreement, payment of permit fee per facility and payment of surety are required prior to construction drawing approval.



City of Durham
Public Works Department
Stormwater Services Divisions

101 City Hall Plaza, Durham, North Carolina, 27701
Telephone (919) 560-4326 FAX (919) 560-4316

Wet Detention Pond Design Summary

Stormwater Management Construction Plan Review:

A complete stormwater management construction plan submittal includes a design summary for each stormwater BMP, design calculations, plans and specifications showing BMP, inlet and outlet structure details.

I. PROJECT INFORMATION

Project Name: _____ Phase _____

PIN: _____ Case #: _____

Design Contact Person: _____ Phone #: (____) ____-_____

Legal Name of Owner: _____

Owner Contact: _____ Phone #: (____) ____-_____

Owner Address: _____

Deed Book _____ Page # _____ or Plat Book _____ Page# _____ for BMP Property

For projects with multiple basins, specify which pond this worksheet applies to: _____

Does the proposed pond also incorporate stormwater detention? Yes No

Detention provided for: _____ 1-year _____ 2-year _____ 10-year _____ other _____

Dam Height: _____ (feet) Dam Classification: _____

Elevations

Pond bottom elevation	_____	ft. (floor of the pond)
Permanent pool elevation	_____	ft. (invert elevation of the orifice)
Temporary pool elevation	_____	ft. (elevation of the structure overflow)
1-year storm orifice/weir elevation	_____	ft. (invert elevation)
1-year storm water surface elevation	_____	ft.
2-year storm orifice/weir elevation	_____	ft. (invert elevation)
2-year storm water surface elevation	_____	ft.
10-year storm orifice/weir elevation	_____	ft. (invert elevation)
10-year storm water surface elev.	_____	ft.
Emergency spillway elevation	_____	ft. (invert of emergency spillway)
Top of embankment/dam	_____	ft. (elevation)
Maximum water surface elevation	_____	ft. (max. storm pond can safely pass)

Areas

Permanent pool area provided	_____	ft ² (water surface area at orifice invert elevation)
Minimum required permanent pool area	_____	ft ² (calculated surface area required)
Design storm surface area	_____	ft ² (Specify frequency event: _____ year)
Drainage area (10-acres min)	_____	ac. (total drainage to the pond)

Discharges (Specify only applicable frequency events)

At BMP

	1-year	2-year	10-year	____-year
Inflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Routed outflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs

At Analysis Point(s) that BMP Contributes to

	1-year	2-year	10-year	____-year
Pre-development	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Post-development w/o detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs
With detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs

Volumes

Permanent pool volume	_____	ft ³ (<i>volume of main pond and forebay</i>)
Water quality pool storage volume	_____	ft ³ (<i>volume above permanent pool</i>)
Design storm storage volume	_____	ft ³ (<i>volume above permanent pool</i>)
Total Storage volume provided at design storm	_____	ft ³
Total Storage volume provided at top of dam	_____	ft ³
Forebay volume	_____	ft ³ (<i>~ 20% of permanent pool volume</i>)

Hydraulic Depths

Volume of normal pool divided by surface area of normal pool	_____	ft.
Volumes at temporary pool plus normal pool divided by surface area of temporary pool	_____	ft.

Other Parameters

SA/DA ¹	_____	(<i>from DWQ table</i>)
Diameter of orifice	_____ in.	(<i>must provide draw down over 2 to 5 day period</i>)
Draw-down time	_____ hrs	

¹ When using the SA/DA tables from the Stormwater Best Management Practices Manual, linear interpolation may be used for values between table entries.

Riser/Principal and Emergency Spillway Information

1-year storm orifice/weir	diameter_____ in.	length _____ft.
2-year storm orifice/weir	diameter_____ in.	length _____ft.
10-year storm orifice/weir	diameter_____ in.	length _____ft.
____- year storm orifice/weir	diameter_____ in.	length _____ft.
Principal spillway	diameter_____ in.	
Emergency spillway	width_____ ft.	side slopes ____:1 slope_____%

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines design requirements. Initial in the space provided to indicate the following design requirements have been met and supporting documentation is attached.

Applicant's initials

- _____ a. The permanent pool depth is between 3- and 6-feet (required minimum hydraulic depth of 3-feet).
- _____ b. The forebay volume is approximately equal to 20% of the pond volume.
- _____ c. The temporary pool controls runoff for water quality design storm.
- _____ d. The temporary pool draws down in 2- to 5-days.
- _____ e. The drainage area to the facility is at least 10-acres.
- _____ f. Riprap outlet protection, if provided, reduces flow to non-erosive velocities (provide calculations).
- _____ g. The pond length to width ratio is greater than or equal to 3:1.
- _____ h. The pond side slopes above the permanent pool area are no steeper than 3:1.
- _____ i. A submerged and vegetated shelf with a slope no greater than 6:1 is provided around the perimeter of the pond (show on plan and profile and provide a vegetation plan).
- _____ j. Vegetative cover above the permanent pool elevation is specified. No woody vegetation is permitted on the embankment.
- _____ k. A surface baffle, trash rack or similar device is provided for both the overflow and orifice. Flat top trash racks are not acceptable. Access hatch has been provided.
- _____ l. A recorded drainage easement is provided for each pond including access to the nearest right-of-way and is graded per Section 8.3, Stormwater Control Facilities (BMPs).
- _____ m. If the basin is used for sediment and erosion control during construction, a note requiring clean out and vegetative cover being established prior to use as a wet detention basin shall be provided on the construction plan.
- _____ n. A mechanism is specified which will drain the pond for maintenance and emergencies. Valves used shall be plug valves.
- _____ o. Anti-floatation calculations are provided for riser structure.
- _____ p. A plan view of the pond with grading shown is provided.
- _____ q. A profile through the forebay, main pond and spillway is provided. Water surface elevations are shown on the profile.
- _____ r. Riser structure details are provided.
- _____ s. Dam designed to account for a 5.00% settlement factor.
- _____ t. Compaction specifications for the embankment are shown on the plan.
- _____ u. The minimum top of dam width has been provided for the pond embankment top width per Section 8.3, Stormwater Control Facilities (BMPs).

Note: Executed Stormwater Facility Operation and Maintenance Permit Agreement, payment of permit fee per facility and payment of surety are required prior to construction drawing approval.



City of Durham

Public Works Department

Stormwater Services Divisions

101 City Hall Plaza, Durham, North Carolina, 27701

Telephone (919) 560-4326 FAX (919) 560-4316

Sand Filter Design Summary

Stormwater Management Construction Plan Review:

A complete stormwater management construction plan submittal includes a design summary for each stormwater BMP, design calculations, plans and specifications showing BMP, inlet and outlet structure details.

I. PROJECT INFORMATION

Project Name: _____ Phase _____

PIN: _____ Case #: _____

Design Contact Person: _____ Phone #: (____) ____-_____

Legal Name of Owner: _____

Owner Contact: _____ Phone #: (____) ____-_____

Owner Address: _____

Deed Book _____ Page # _____ or Plat Book _____ Page# _____ for BMP Property

For projects with multiple basins, specify which pond this worksheet applies to: _____

Drainage area _____ ac. (total drainage area to the sand filter)

Impervious area _____ ac. (total impervious area to the sand filter)

Design runoff _____ in.

Design treatment volume (540 ft³/Ac) _____ ft³

Sediment chamber design

Bottom elevation _____ ft. (floor of the sediment chamber)

Weir elevation _____ ft. (invert elevation of overflow to sand bed)

Volume _____ ft³ (volume of sediment chamber to weir elevation)

Surface area _____ ft² (surface area of sediment chamber at bottom)

Design treatment volume provided _____ ft³

Sand filter bed design

Bottom elevation _____ ft. (elevation of bottom of sand bed)

Top of sand _____ ft. (elevation of top of sand)

Sand volume _____ ft³ (volume of sand in bed)

Sand surface area _____ ft² (surface area of sand bed at bottom of bed)

Design treatment volume provided _____ ft³

Perforated pipe length _____ ft. (length of perforated pipe provided under sand bed)

Diameter of perforated pipe _____ in. (pipe diameter of perforated pipe)

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines design requirements. Initial in the space provided to indicate the following design requirements have been met and supporting documentation is attached.

Applicant's initials

- _____ a. Runoff from landscaped areas and other non-impervious areas has been directed away from the sand filter to the maximum extent practical.
- _____ b. Drainage area for sand filter is less than 5-acres.
- _____ c. Maximum water quality head over the sand filter is 12" or less.
- _____ d. Plan specifies how all slopes draining to the sand filter will be stabilized.
- _____ e. No side slopes draining to sand filter greater than 3:1.
- _____ f. Design drawings provide note: "All slopes draining to sand filter shall be stabilized per the North Carolina State Erosion and Sediment Control Planning and Design Manual before sand is placed in sand bed."
- _____ g. Riprap outlet protection, if provided, reduces flow to non-erosive velocities (provide calculations).
- _____ h. A recorded drainage easement is provided for each sand filter including access to the nearest right-of-way and is graded per Section 8.3, Stormwater Control Facilities (BMPs).
- _____ i. Anti-floatation calculations are provided for riser structure.
- _____ j. A surface baffle, trash rack or similar device is provided for both the overflow and orifice. Flat top trash racks are not acceptable. Access hatch has been provided.
- _____ k. A plan view of the sand filter with grading shown is provided.
- _____ l. A profile through the settling chamber, sand bed and spillway is provided. Water surface elevations are shown on the profile.
- _____ m. Riser structure details are provided.
- _____ n. Compaction specifications for the embankment are provided on the plan.
- _____ o. Runoff from storms larger than the 1-year storm are routed around the sand bed.
- _____ p. Sand size, type and gradation specified. The sand shall be a clean ASTM C-33 medium aggregate sand with a size range of 0.02-inch to 0.04-inch.

Note: Executed Stormwater Facility Operation and Maintenance Permit Agreement, payment of permit fee per facility and payment of surety are required prior to construction drawing approval.



City of Durham
Public Works Department
Stormwater Services Divisions

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Bio-Retention Area Design Summary

Stormwater Management Construction Plan Review:

A complete stormwater management construction plan submittal includes a design summary for each stormwater BMP, design calculations, plans and specifications showing BMP, inlet and outlet structure details.

I. PROJECT INFORMATION

Project Name: _____ Phase _____

PIN: _____ Case #: _____

Design Contact Person: _____ Phone #: (____) ____-_____

Legal name of Owner: _____

Owner Contact: _____ Phone #: (____) ____-_____

Owner Address: _____

Deed Book _____ Page # _____ or Plat Book _____ Page# _____ for BMP Property

For projects with multiple basins, specify which pond this worksheet applies to: _____

Drainage area	_____	ac	(on-site drainage to the area, 1-acre max ¹)
Impervious area	_____	ac	(on-site impervious area draining to facility)
Design runoff	_____	cfs	
Design treatment volume	_____	ft ³	

¹ Assumes 100% impervious, larger areas may be considered if maximum sheet flow velocity is not exceeded

Bioretention Design

Grass buffer strip width	_____	ft	(Max slope of 4:1 and minimum width of 10 feet or a forebay)
Size of cell area	_____	ft ²	(Min 5% of drainage area with sand bed, 7% without bed)
Depth of ponding area	_____	ft	(6-inches max)
Width of cell	_____	ft	(Minimum width of 25-feet ²)
Length of cell	_____	ft	(Minimum length of 2 times the width)
Inflow sheet flow velocity	_____	ft/s	(Maximum of 1-foot/second)
Mulch layer elevation	_____	ft	(Elevation of top of layer)
Planting soil top elevation	_____	ft	(Elevation of top of soil)
Depth of planting soil	_____	ft	(Minimum depth of 4-feet ³)
Top of sand if applicable	_____	ft	(Elevation of top of sand)
Bottom elevation	_____	ft	(Elevation of bottom of cell)
Perforated pipe length	_____	ft	(Length of perforated pipe provided under cell layers)
Space between pipe runs	_____	ft	(Spacing between perforated pipe runs, max of 10-feet)

² Smaller widths may be accepted in urbanized areas or in retrofit situations. These designs will be evaluated on a case-by-case basis.

³ Smaller depths may be accepted in urbanized areas or in retrofit situations. These designs will be evaluated on a case-by-case basis.

Longitudinal slope _____ ft (1% minimum longitudinal slope)
 Diameter of pipe _____ in (Pipe diameter of perforated pipe, min of 6-inches)

Emergency Spillway Information

Emergency outlet elev. _____ ft (invert of emergency overflow weir)
 Emergency spillway width _____ ft. side slopes ____:1 slope _____%

II. REQUIRED ITEMS CHECKLIST

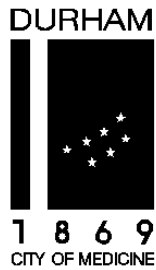
The following checklist outlines design requirements. Initial in the space provided to indicate the following design requirements have been met and supporting documentation is attached.

Applicant's initials

- _____ a. Runoff from landscaped areas and other non-impervious areas has been directed away from the bioretention area to the maximum extent practical.
- _____ b. Drainage area for bioretention area is less than 1-acre.
- _____ c. Plan specifies how all slopes draining to the bioretention area will be stabilized, note that the slopes must be stabilized before installation of the under drain system.
- _____ d. Construction sequencing shall be considered and a note added to the plan that states: "All sediment and erosion control practices shall be in place and the slopes draining to the bioretention area shall be stabilized before construction of the bioretention area begins."
- _____ e. No side slopes draining to bioretention area greater than 3:1, promote sheet flow through the grass filter strip.
- _____ f. Riprap outlet protection, if provided, reduces flow to non-erosive velocities (provide calculations).
- _____ g. A recorded drainage easement is provided for each cell including access to the nearest right-of-way and is graded per Section 8.3, Stormwater Control Facilities (BMPs).
- _____ h. A plan view of the bioretention area with grading shown is provided.
- _____ i. A profile through the bioretention area and emergency spillway is provided.
- _____ j. Geotextile fabric is placed at the bottom of the excavated cell to prevent soil from getting into the underdrain system.
- _____ k. The underdrain system is wrapped in a gravel jacket and a geotextile fabric is placed between the bottom of the sand bed or planting soil and the top of the gravel jacket.
- _____ l. The pipe for the underdrain system shall be perforated Schedule 40 PVC.
- _____ m. The underdrain system shall connect to the outflow system at a point at least 1 foot inside the bioretention cell wall.
- _____ n. A non-perforated piping system is connected to the underdrain piping and extends to the surface of the planting soil for cleanouts.
- _____ o. Cleanouts are to be provided at the beginning of each pipe run and at all intersections.
- _____ p. A planting soil mixture specification and a soil characteristics table are provided. Maximum clay content in the soil mixture is 8.00%.
- _____ q. The hydraulic conductivity for the planting mixture is to be 1-inch to 2-inches per hour.
- _____ r. Mulch layer specification is provided; mulch is to be a 4-inch layer of coarse hardwood mulch with re-application rate specified.
- _____ s. Soil with a P index of less than or equal to 25 specified on plan.
- _____ t. A bioretention area landscape plan is provided including the transport of plant material, preparation of the planting pit, fertilization, installation of the plant material, type and number of plantings (note that there shall be a minimum of three species of trees and three species of

shrubs selected to insure diversity, their planting locations, post-installation inspection and maintenance guidelines.

Note: Executed Stormwater Facility Operation and Maintenance Permit Agreement, payment of permit fee per facility and payment of surety are required prior to construction drawing approval.



City of Durham
Public Works Department
Stormwater Services Divisions

101 City Hall Plaza, Durham, North Carolina, 27701
Telephone (919) 560-4326 FAX (919) 560-4316

Constructed Wetland and Pocket Wetland Design Summary

Stormwater Management Construction Plan Review:

A complete stormwater management construction plan submittal includes a design summary for each stormwater BMP, design calculations, plans and specifications showing BMP, inlet and outlet structure details.

I. PROJECT INFORMATION

Project Name: _____ Phase _____

PIN: _____ Case #: _____

Design Contact Person: _____ Phone #: (____) ____-_____

Legal Name of Owner: _____

Owner Contact: _____ Phone #: (____) ____-_____

Owner Address: _____

Deed Book _____ Page # _____ or Plat Book _____ Page# _____ for BMP Property

For projects with multiple basins, specify which pond this worksheet applies to: _____

Does the proposed pond also incorporate stormwater detention? Yes No

Detention provided for: _____ 1-year _____ 2-year _____ 10-year _____ other _____

Dam Height: _____ (feet) Dam Classification: _____

Elevations

Wetland bottom elevation	_____	ft. (<i>floor of the wetland</i>)
Permanent pool elevation	_____	ft. (<i>invert elevation of the orifice</i>)
Temporary pool elevation	_____	ft. (<i>elevation of the structure overflow</i>)
1-year storm orifice/weir elevation	_____	ft. (<i>invert elevation</i>)
1-year storm water surface elevation	_____	ft.
2-year storm orifice/weir elevation	_____	ft. (<i>invert elevation</i>)
2-year storm water surface elevation	_____	ft.
10-year storm orifice/weir elevation	_____	ft. (<i>invert elevation</i>)
10-year storm water surface elev.	_____	ft.
Emergency spillway elevation	_____	ft. (<i>invert of emergency spillway</i>)
Top of embankment/dam	_____	ft. (<i>elevation</i>)
Maximum water surface elevation	_____	ft. (max. storm pond can safely pass)
Depth from design storm to Lowest orifice elevation	_____	ft.

Areas

Permanent pool area provided	_____	ft ² (<i>water surface area at orifice invert elevation</i>)
Minimum required perm. pool area	_____	ft ² (<i>calculated surface area required</i>)
Design storm surface area	_____	ft ² (<i>Specify frequency event: _____ year</i>)
Drainage area (10-acres min to Constructed Wetland)	_____	ac. (<i>total drainage to the wetland</i>)

Discharges (Specify only applicable frequency events)

At BMP

	1-year	2-year	10-year	____-year
Inflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Routed outflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs

At Analysis Point(s) that BMP Contributes to

	1-year	2-year	10-year	____-year
Pre-development	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Post-development w/o detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs
With detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs

Volumes

Permanent pool volume	_____ ft ³	(volume of main pond and forebay)
Water quality pool storage volume	_____ ft ³	(volume above permanent pool)
Design storm storage volume	_____ ft ³	(volume above permanent pool)
Total Storage volume provided at design storm	_____ ft ³	
Total Storage volume provided at top of dam	_____ ft ³	
Forebay volume (Constructed Wetlands only)	_____ ft ³	

Environmental Zones

Zone	Water Depth at Normal Pool¹	Water Depth at Temporary Pool (Max Depth of 12-inches above Normal Pool)¹	Portion of Temporary Pool Surface Area
Deep Pool			
Low Marsh			
High Marsh			
Woody Upland			

¹ Depths are to be calculated using the hydraulic depth calculation for each zone. Hydraulic Depth is the volume of water at an elevation divided by the water surface area at the same elevation.

Other Parameters

SA/DA ²	_____	(from DWQ table)
Diameter of orifice	_____ in.	(must provide draw down over 2 to 5 day period)
Draw-down time	_____ hrs	
Design TSS removal	_____ %	(minimum 85% removal required)

² When using the SA/DA tables from the NCDENR BMP Manual, linear interpolation may be used for values between table entries.)

Riser/Principal and Emergency Spillway Information

1-year storm orifice/weir	diameter_____ in.	length _____ft.	
2-year storm orifice/weir	diameter_____ in.	length _____ft.	
10-year storm orifice/weir	diameter_____ in.	length _____ft.	
____- year storm orifice/weir	diameter_____ in.	length _____ft.	
Principal spillway	diameter_____ in.		
Emergency spillway	width_____ ft.	side slopes ____:1	slope_____%

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines design requirements. Initial in the space provided to indicate the following design requirements have been met and supporting documentation is attached.

Applicant's initials

- _____ a. The forebay volume is approximately equal to 20% of the pond volume.
- _____ b. The temporary pool controls runoff for water quality design storm.
- _____ c. The temporary pool draws down in 2- to 5-days.
- _____ d. The drainage area to a Constructed Wetland is at least 10-acres. Smaller drainage areas to Pocket Wetlands will be reviewed on a case-by-case basis.
- _____ e. Riprap outlet protection, if provided, reduces flow to non-erosive velocities (provide calculations).
- _____ f. The wetland length to width ratio is greater than or equal to 3:1.
- _____ g. The wetland side slopes above the permanent pool area are no steeper than 3:1.
- _____ h. A submerged and vegetated shelf with a slope no greater than 6:1 is provided around the perimeter of the pond (show on plan and profile and provide a vegetation plan).
- _____ i. Vegetative cover above the permanent pool elevation is specified. No woody vegetation is permitted on the embankment.
- _____ j. A surface baffle, trash rack or similar device is provided for both the overflow and orifice. Flat top trash racks are not acceptable. Access hatch has been provided.
- _____ k. A recorded drainage easement is provided for each pond including access to the nearest right-of-way and is graded per Section 8.3, Stormwater Control Facilities (BMPs).
- _____ l. If the basin is used for sediment and erosion control during construction, a note requiring clean out and vegetative cover being established prior to use as a wet detention basin shall be provided on the construction plan.
- _____ m. A mechanism is specified which will drain the pond for maintenance and emergencies. Valves used shall be plug valves.
- _____ n. Anti-floatation calculations are provided for riser structure.
- _____ o. A plan view of the wetland with grading shown is provided.
- _____ p. A profile through the forebay, wetland and spillway is provided. Water surface elevations are shown on the profile.
- _____ q. Riser structure details are provided.
- _____ r. Dam designed to account for a 5.00% settlement factor.
- _____ s. Compaction specifications for the embankment are shown on the plan.
- _____ t. The minimum top of dam width has been provided for the wetland embankment top width per Section 8.3, Stormwater Control Facilities (BMPs)

Note: Executed Stormwater Facility Operation and Maintenance Permit Agreement, payment of permit fee per facility and payment of surety are required prior to construction drawing approval



City of Durham
Public Works Department
Stormwater Services Divisions

101 City Hall Plaza, Durham, North Carolina, 27701
Telephone (919) 560-4326 FAX (919) 560-4316

Underground Detention Design Summary

Stormwater Management Construction Plan Review:

A complete stormwater management construction plan submittal includes a design summary for each stormwater BMP, design calculations, plans and specifications showing BMP, inlet and outlet structure details.

I. PROJECT INFORMATION

Project Name: _____ Phase _____

PIN: _____ Case #: _____

Design Contact Person: _____ Phone #: (____) ____ - _____

Legal Name of Owner: _____

Owner Contact: _____ Phone #: (____) ____ - _____

Owner Address: _____

Deed Book _____ Page # _____ or Plat Book _____ Page# _____ for BMP Property

For projects with multiple basins, specify which pond this worksheet applies to: _____

Detention provided for: _____ 1-year _____ 2-year _____ 10-year _____ other _____

Elevations

Bottom elevation	_____	ft. (<i>invert out elevation of system</i>)
1-year storm orifice/weir elevation	_____	ft. (<i>invert elevation</i>)
1-year storm water surface elevation	_____	ft. (<i>elevation at the outlet of system</i>)
2-year storm orifice/weir elevation	_____	ft. (<i>invert elevation</i>)
2-year storm water surface elevation	_____	ft. (<i>elevation at the outlet of system</i>)
10-year storm orifice/weir elevation	_____	ft. (<i>invert elevation</i>)
10-year storm water surface elevation	_____	ft. (<i>elevation at the outlet of system</i>)
Emergency spillway elevation	_____	ft. (<i>invert of emergency spillway</i>)
Ground Surface Elevation	_____	ft. (<i>elevation of ground above outlet</i>)
Maximum Water Surface Elevation (____-year storm)	_____	ft. (<i>elevation at the outlet of system</i>)

Areas

Drainage area _____ ac. (*total drainage to the facility*)

Volumes

Total Storage Volume Provided _____ ft³ (*volume detained at design storm*)

Discharges (Specify only applicable frequency events)

At BMP

	1-year	2-year	10-year	____-year
Inflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Routed outflow	_____ cfs	_____ cfs	_____ cfs	_____ cfs

At Analysis Point(s) that BMP Contributes to

	1-year	2-year	10-year	____-year
Pre-development	_____ cfs	_____ cfs	_____ cfs	_____ cfs
Post-development w/o detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs
With detention	_____ cfs	_____ cfs	_____ cfs	_____ cfs

System Information

1-year storm orifice/weir	diameter_____ in.	length _____ft.	
2-year storm orifice/weir	diameter_____ in.	length _____ft.	
10-year storm orifice/weir	diameter_____ in.	length _____ft.	
____- year storm orifice/weir	diameter_____ in.	length _____ft.	
Principal spillway	diameter_____ in.		
Emergency spillway	width_____ ft.	side slopes ____:1	slope_____%

II. REQUIRED ITEMS CHECKLIST

The following checklist outlines design requirements. In the space provided to indicate the following design requirements have been met and supporting documentation is attached.

Applicant's initials

- _____ a. Riprap outlet protection, if provided, reduces flow to non-erosive velocities (provide calculations).
- _____ b. The system consists of two 60-inch minimum header pipes and two 60-inch minimum perimeter pipes. 36-inch interior pipes for additional storage are provided if needed.
- _____ c. Manhole access has been provided at the 4 corners of the system.
- _____ d. Traffic bearing cleanouts have been provided every 100-feet with a minimum of two per pipe run. Manholes may be counted as cleanouts.
- _____ e. A traffic bearing door (bilco type or approved equal) has been placed at the inlet and outlet of the system.
- _____ f. Spacing of pipe runs are per the manufacturer's specification.
- _____ g. The backfill material has been certified by a Geotechnical Engineer.
- _____ h. The system is water tight for the 10-year hydrostatic pressure calculated at the inlet to the system.
- _____ i. A surface or sub-surface bypass has been sized to safely convey the maximum required design storm.
- _____ j. An operation and maintenance plan for the system has been provided.
- _____ k. A recorded drainage easement is provided for each basin including access to the nearest right-of-way and is graded per Section 8.3, Stormwater Control Facilities (BMPs).
- _____ l. A plan view of the system with grading shown is provided

- _____ m. A profile through the system and emergency bypass is provided. Water surface elevations are shown on the profile.
- _____ n. Outlet structure details are provided.
- _____ o. Compaction specifications for the installation of the system are provided on the plan.

Note: Executed Stormwater Facility Operation and Maintenance Permit Agreement, payment of permit fee per facility and payment of surety are required prior to construction drawing approval.

SECTION 9.0

STREETS

This section is intended to provide design criteria for construction plans. The Department of Transportation is responsible for reviewing and approving the general design layout of traffic flow patterns. Refer to Section 10.0, Transportation, for questions concerning traffic flow, turn lanes, proposed pavement width, etc.

The City and the County of Durham have adopted street standards for public and private streets. The Table of Minimum Design Requirements for Public and Private Residential Streets (PDF format - Acrobat Reader required) identifies the standard design criteria for street size and capacity and typical cross sections. In general all streets are designed according to their usage and proposed traffic volume and the City of Durham Street Construction Specifications.

When a project involves or is adjacent to an existing street, an investigation should be made as to the current maintenance of that street. Information on streets maintained by the City of Durham is listed in the Powell Bill, found at http://www.durhamnc.gov/departments/works/pdf/powell_bill.pdf.

I. General

1. All street construction, public and private, will conform to the requirements listed in Section 2.1, Construction Plan Approval Process.
2. The Engineer shall provide a pavement design that shall be based on projected traffic volumes and percentage of trucks. The minimum pavement design for a residential street is 8-inch ABC stone base course, 1.5-inch S9.5B initial course, and 1-inch SF9.5A final course. The minimum pavement design for a residential collector or thoroughfare is 10-inch ABC stone base course, 2-inch S9.5B initial course, and 1-inch SF9.5A final course. The minimum pavement design for a commercial or industrial street is 10-inch ABC stone base course, 3-inch S9.5B initial course, and 1-inch SF9.5A final course. Traffic characteristics or soil conditions may dictate increased stronger pavement section in any case.
3. Superelevated curves are not used on residential streets except by special approval.
4. Reverse Curves-horizontal
 - a. For design speeds of 25-mile per hour (mph) or less, a minimum of 25-feet of tangent on residential streets is required.
 - b. For design speeds greater than 25-mph, a minimum of 50-feet of tangent on residential streets is required.
5. No PCCs (point of compound curve) will be allowed.
6. On residential and non-residential streets, cul-de-sacs shall have a minimum 37-foot to back of curb roadway radii, 35-foot back of curb throat radii, 46-foot right-of-way radius, and 26-foot right of way throat radii (24-inch curb and gutter section). For a 30-inch curb and gutter section, cul-de-sacs shall have a minimum 37.5-foot to back of curb roadway radii, 34.5-foot back of curb throat radii, 46.5-foot right-of-way radius, and 25.5-foot right of way throat radii.
7. All storm drainage to conform to current City of Durham standards and policy.
8. Street signage along public streets and on private streets/drives will be the responsibility of the entity(ies) responsible for the development and placed according to the standards of the City of Durham and NCDOT, as applicable (see Section 10.0, Transportation). The street signage on public streets will be maintained by the entity(ies) of the development up to the time when the street is accepted by the City of

Durham or NCDOT, as applicable. The street signage for private streets will be maintained by the entity(ies) of the development. All signage shall conform to MUTCD (Manual on Uniform Traffic Control Devices) Standards.

9. Anticipated street classification, traffic volume, design speed, sight distances and other relevant standards shall govern horizontal and vertical curves and roadway alignment.
10. Intersections shall intersect at 90-degrees with minimum of 70-degrees (only on a case by case review).
11. Desirable maximum profile grade is 10%. Minimum desirable grade is 1%.
12. Grades should not exceed 3% for the first 300 feet from the centerline of any publicly maintained road for a residential collector/non-residential street. Grades should not exceed 5% for the first 100-feet from the centerline of any publicly maintained road for a residential street.
13. The use of a grade break, in lieu of a vertical curve, will be allowed only when the algebraic difference in the road grades is 0.80 or less.
14. Desirable curb radii for all intersecting streets are 30-feet with a minimum radius of 25-feet. Nonresidential and collectors require larger radii.
15. Plans for all widening shall show that the contractor will saw and remove the top 1 ½-inches of existing pavement a minimum of 12-inches from the edge, or as directed by the city, and place new pavement over the existing base. This may include additional surfacing up to full width of road as directed by the Department of Public Works.
16. Curb and gutter and roll curb shall be City of Durham standard (see Durham Street Specifications). NCDOT median curb is accepted for medians and islands. Roll curb shall transition to standard curb at all radii, catch basins, fire hydrants, and as directed by the Engineering inspector during construction.
17. ABC stone (Road Base) to extend under curb and gutter and terminate 6-inches beyond back of curb.
18. At all non-residential driveways, a 48-inch valley gutter is to be used unless an approved street type driveway intersection is approved. Minimum radii for all non-residential driveways will be 10-feet. Increased radii maybe required depending upon the project (Greater than 500 ADT will require a minimum 25-foot radius driveway).
19. Where streets terminate (example Phase lines) the following will be installed:
 - a. Asphalt header.
 - b. Riprap or concrete apron for storm water to dissipate.
 - c. Utilities to extend a minimum of 5-feet beyond the edge of pavement.
 - d. NCDOT type III barricade.
20. On projects involving irrigation systems within median areas, underdrain pipe shall be installed as follows:
 - a. Starting at a roadway low point, install a minimum of 100-lineal feet in both directions from the low point, along both sides of the median.
 - b. Along a section of road with "pickup" basins, a minimum of 100-lineal feet on the uphill side of the basins, on both sides of the median.
 - c. At the downhill end of the median, if the end is not at a low point.If during construction, a situation arises where water is coming from somewhere and there is a chance that the water could cause problems with the road, utilities or sidewalks, etc., additional underdrain will be required to drain the area.

The underdrain shall be directed to discharge into a drainage structure. No underdrain pipe shall cross roadway. Junction boxes and catch basins shall be added along median to intercept the underdrain as needed.
21. At a location where a wide street with curb and gutter tapers in to match a narrower street, without curb

and gutter, the curb and gutter shall not follow the taper. The distance between the ends of the curb and gutter shall be the width of the wider pavement area.

22. Temporary turnarounds are required when the street stub length is equal to or greater than 150-feet from the centerline of the intersection to the end of the stub or if there are 6 lots or more located adjacent to the street stub. A temporary cul-de-sac, built to permanent cul-de-sac standards, are required when the street stub length is equal to or greater than 300-feet from the centerline of the intersection to the end of the stub or if there are 10 lots or more located adjacent to the street stub.
23. At stream crossings, the road must be built to the full City of Durham cross-section.
24. For acceptable K values for vertical curves, refer to the latest edition of the AASHTO publication entitled "A Policy on Geometric Design of Highways and Streets (Green Book)."
25. For projects involving signalized intersection(s), an electronic copy of the approved construction drawings are to be submitted to the Traffic Operations Engineer, Transportation Division. Contact Transportation Division regarding submittal process. Submittals to take place only after Construction Drawings are approved.
26. At all road stubs to adjacent properties where required by the Public Works Department, the consultant shall provide all requested future street profiles for review and approval.

II. Construction

1. Refer to Section 2.1, Construction Plan Approval Process.
2. Immediately following placement and acceptance of the stone base, the 1 ½-inch of S9.5B asphalt shall be installed. Placement of the final 1-inch of SF9.5A shall occur within 1-year following the placement of the 1 ½-inch of S9.5B or near the full build-out of the dwelling units. Items within the pavement, such as valve boxes, manhole frames and covers, catch basin frames and grates, etc, shall be set to final road elevations prior to placement of the initial 1 ½-inch of S9.5B. To prevent damage to these items during the delay of the final SF9.5A placement, additional asphalt shall be "feathered" in around them.
3. All subgrade material shall be compacted to 95% standard proctor. The stone base shall be compacted to 100% standard proctor.
4. All driveway entrances must meet City of Durham standards or as subsequently amended or meet NCDOT if the driveways are located on the State Highway System. Permits are required before construction on both City and State roads (see Section 3.0, Permitting).
5. All work must carry a one-year warranty from the date of City's acceptance on materials and workmanship including damages from settlement.
6. Construction standards shall meet City of Durham Engineering Division's standards and specifications and N. C. Department of Transportation Standard Specifications for Roads and Structures, as revised 2002, (and as subsequently amended) and AASHTO's "A Policy on Geometric Design of Highways and Streets, 4th Edition" (2001), except where standards in these Guidelines are more stringent.

TABLE OF MINIMUM DESIGN REQUIREMENTS FOR PUBLIC AND PRIVATE RESIDENTIAL STREETS

Commercial, Office, Industrial Development will be reviewed separately
See also INGRESSEGRESS requirements of the Durham Zoning Ordinance for use limits (Section 8.1.13)

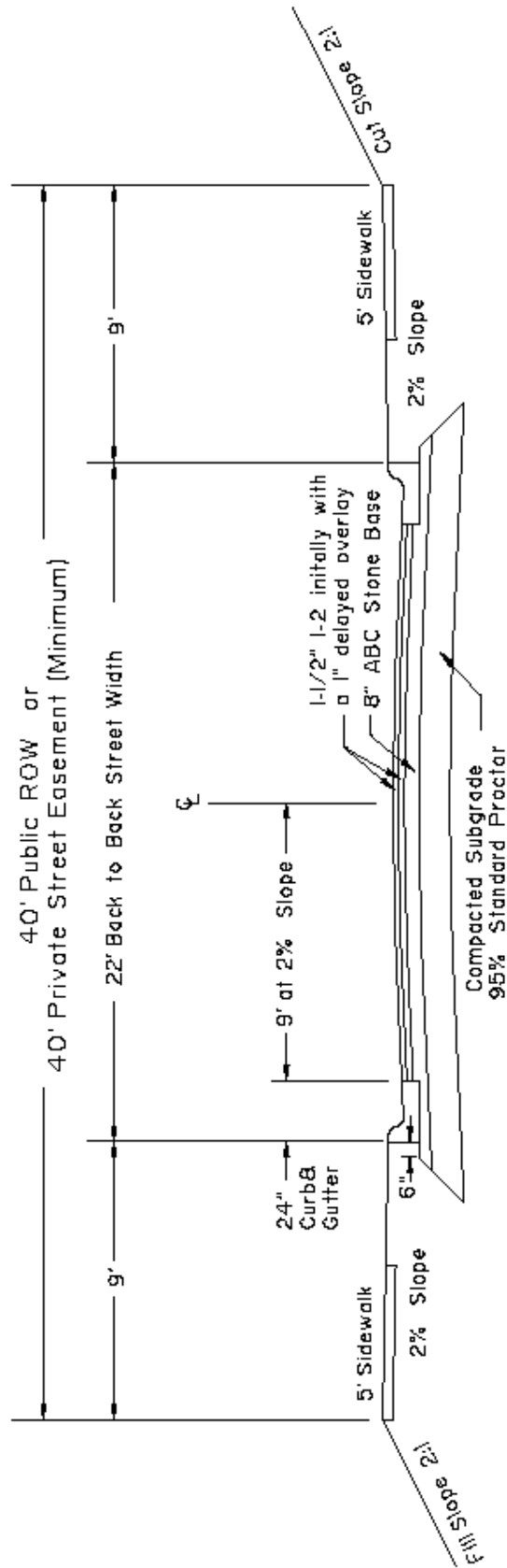
Street Type	Maintenance		Speed Limit	Total Pavement Width		Public ROW Width (See note #2 & #3 below)	Private Street Easement (Minimum Width)	Pavement (See note #4 below)	Units Served	Vehicle Volume Average Daily Traffic	Design Speed Vertical (Min.)	Centerline Radius	Corner Radii
	Public	Private		With Curb	Without Curb Edge to Edge								
ALLEY <i>Limited side-sway access to Must be able No utilities sharing alley.</i>	Public	Private	10 MPH	N/A	12'	20'	20'	3" ABC + 6" Concrete Inverted crown	Case by case.	Case by case.	Case by case.	35' or ability to negotiate turn.	N/A
RESIDENTIAL LIMITED Same if adding parking bays.	Public		10 MPH	22'	22' plus 6' shoulders	WITH Curb = 40' WITHOUT Curb = 60'		8" ABC+11/2" 1" or equal See note #6	Up to 15, 20 mile 2 or more vehicles	< 150 ADT	25 MPH	50'	10'
RESIDENTIAL LIMITED Same if adding parking bays.		Private	10 MPH	22'	22' plus 6' shoulders		WITH Curb = 40' BAY = As needed to include bay WITHOUT Curb = 60'	8" ABC+11/2" 1" or equal See note #6	Up to 15.	< 150 ADT	25 MPH	50'	10'
RESIDENTIAL STREET Same if adding parking bays.	Public		15 MPH	24'	22' plus 6' shoulders			8" ABC+11/2" 1" or equal See note #6	Up to 25	< 250 ADT	25 MPH	100'	20'
RESIDENTIAL STREET Same if adding parking bays.		Private	15 MPH	24'	22' plus 6' shoulders	WITH Curb = 40' WITHOUT Curb = 60'	WITH Curb = 40' BAY = As needed to include bay WITHOUT Curb = 60'	8" ABC+11/2" 1" or equal See note #6	Up to 25	< 250 ADT	25 MPH	100'	20'
RESIDENTIAL LOCAL STREET (No Parking) See note #4 RESIDENTIAL LOCAL STREET (With Parking)	Public		25 MPH	26' 32'	22' plus 6' shoulders			8" ABC+11/2" 1" or equal See note #6	Up to 100	< 1000 ADT	25 MPH	181'	20'
RESIDENTIAL LOCAL STREET (No Parking) See note #4 RESIDENTIAL LOCAL STREET (With Parking)		Private	25 MPH	26' 32'	22' plus 6' shoulders	WITH Curb=50' WITHOUT Curb =70'	WITH Curb = 50' WITHOUT Curb =70'	8" ABC+11/2" 1" or equal See note #6	Up to 100	< 1000 ADT	25 MPH	181'	20'
RESIDENTIAL MAJOR LOCAL STREET (No Parking) See note #4 RESIDENTIAL MAJOR LOCAL STREET (With Parking)	Public		30 MPH	26' 32'	22' plus 6' shoulders			8" ABC+11/2" 1" or equal See note #6	100-250	1000-2500 ADT	30 MPH	300'	25'
RESIDENTIAL MAJOR LOCAL STREET (No Parking) See note #4 RESIDENTIAL MAJOR LOCAL STREET (With Parking)		Private	30 MPH	26' 32'	22' plus 6' shoulders	WITH Curb=50' WITHOUT Curb =70'	WITH Curb = 50' WITHOUT Curb =70'	8" ABC+11/2" 1" or equal See note #6	100-250	1000-2500 ADT	30 MPH	300'	25'
COLLECTOR (No Parking) See note #4	Public	Private	35 MPH	41'	N/A	WITH Curb = 60'	WITH Curb = 60'	To be designed	250-400	2500-4000 ADT	35 MPH	480'	30'
MINOR THOROUGHFARES MAJOR THOROUGHFARES FREEWAYS	To be determined by the City To be determined by the City To be determined by the City.												

General Notes

- a. Dimensions are based upon using a 24" upright curb and gutter section measuring from Back of Curb to Back of Curb (BC/BC). The COLLECTOR has a 30" upright curb and gutter.
- b. 30" roll curb can be used as a substitute for the 24" C&G on RESIDENTIAL LIMITED, RESIDENTIAL STREET and RESIDENTIAL LOCAL STREET but add 1" to the BC/BC dimension, and reduce treelawn by 0.5' each.
- c. Roll curb can not be used as a substitute for the RESIDENTIAL MAJOR LOCAL and COLLECTOR.
- d. No above ground utility structures within the Street ROW or Public Street Easement unless approved by Engineering Department.
- e. The pavement structure design may increase depending upon soil conditions and/or projected traffic volumes.
- f. Street sections designed for No Parking shall have signs installed at the developer's expense indicating no parking zones as required by the City.
- g. Landscaping and improvements are allowed within the Street ROW or Public Street Easements only by approval of the City or NCDOT.
- h. 1 1/2" F-2 to be installed immediately following ABC placement. 1" F-2 placement to be delayed until 6 months after the placement of the 1 1/2" of F-2.

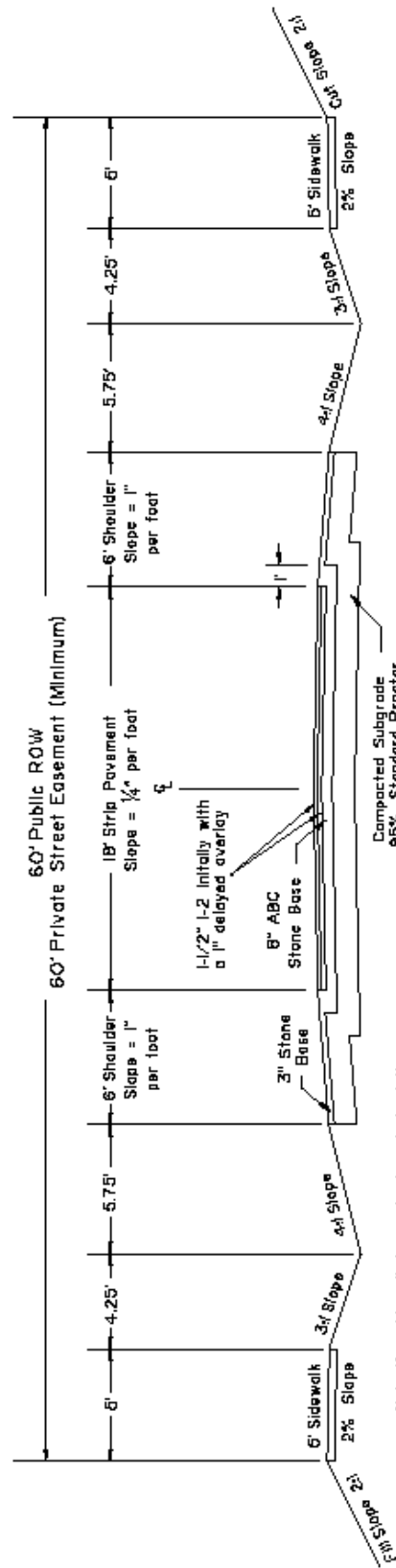
Revisions Order Sept, 2000

RESIDENTIAL LIMITED STREET WITH CURB

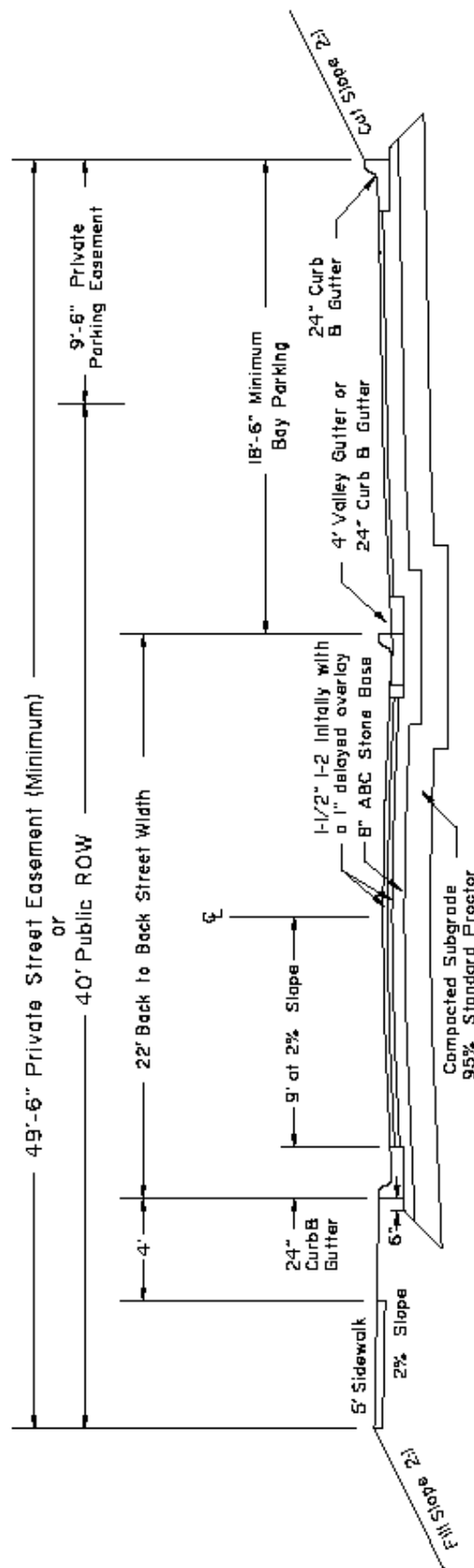


Note: If a sidewalk is required or desired, the location may vary. Additional easement width may be required. See Sidewalk Ordinance.

RESIDENTIAL LIMITED STREET WITHOUT CURB



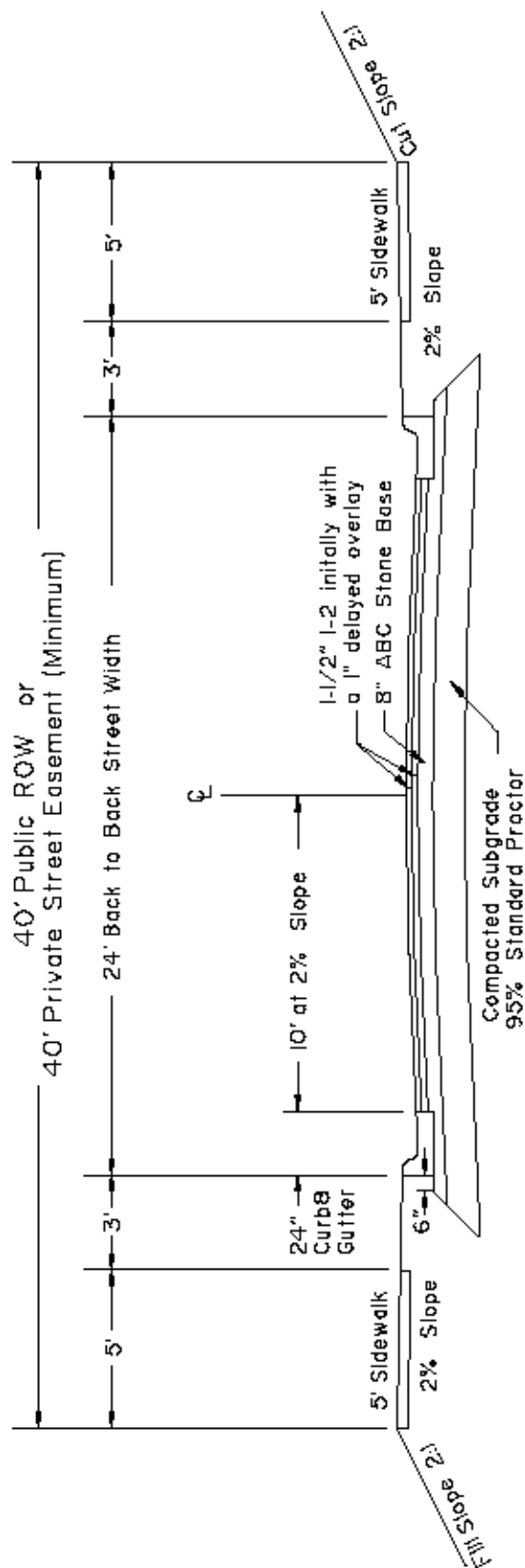
RESIDENTIAL LIMITED STREET WITH CURB & BAY PARKING



Note: If a sidewalk is required or desired, the location may vary. Additional easement width may be required. See Sidewalk Ordinance.

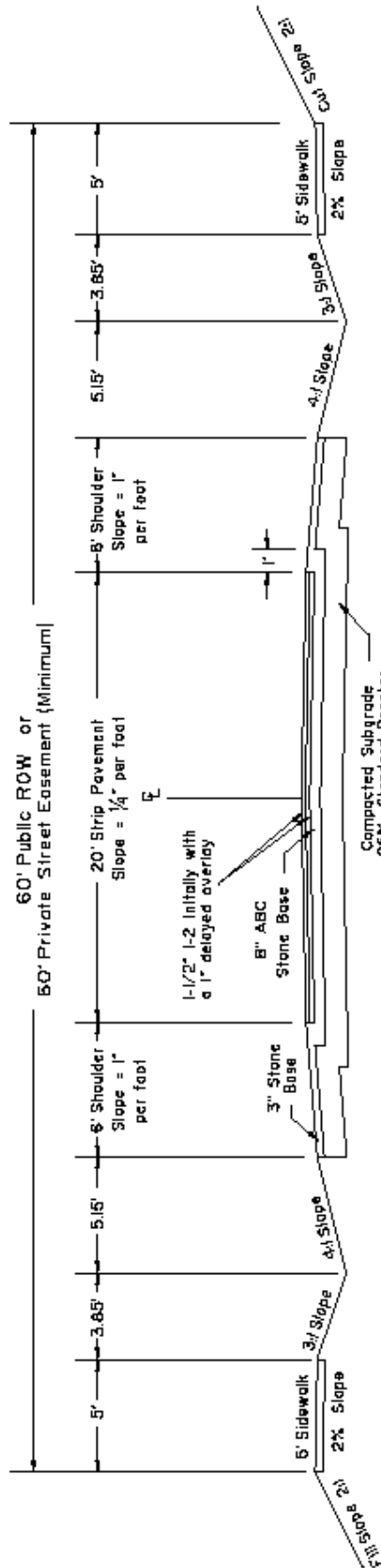
Note: Bays are located on one side of the street only. Bays may alternate from one side of the street to the other, but cannot be located on both sides of the street at any one location.

RESIDENTIAL STREET WITH CURB



Note: If a sidewalk is required or desired, the location may vary. Additional easement width may be required. See Sidewalk Ordinance.

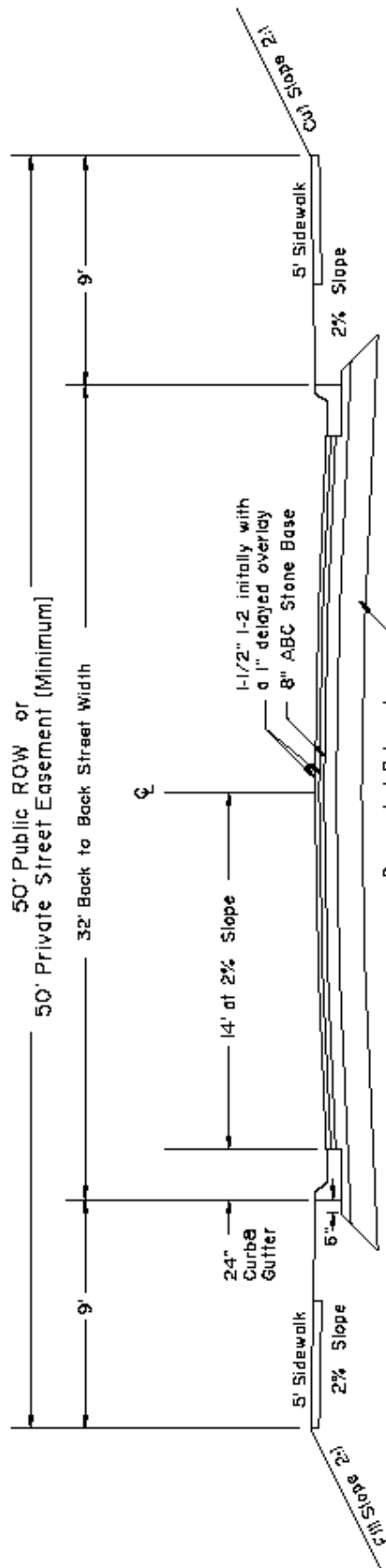
RESIDENTIAL STREET WITHOUT CURB



Note: If a sidewalk is required or desired, the location may vary. Additional easement width may be required. See Sidewalk Ordinance.

Note: Boys are located on one side of the street only. Boys may alternate from one side of the street to the other, but cannot be located on both sides of the street at any one location.

RESIDENTIAL LOCAL STREET WITH CURB WITH PARKING



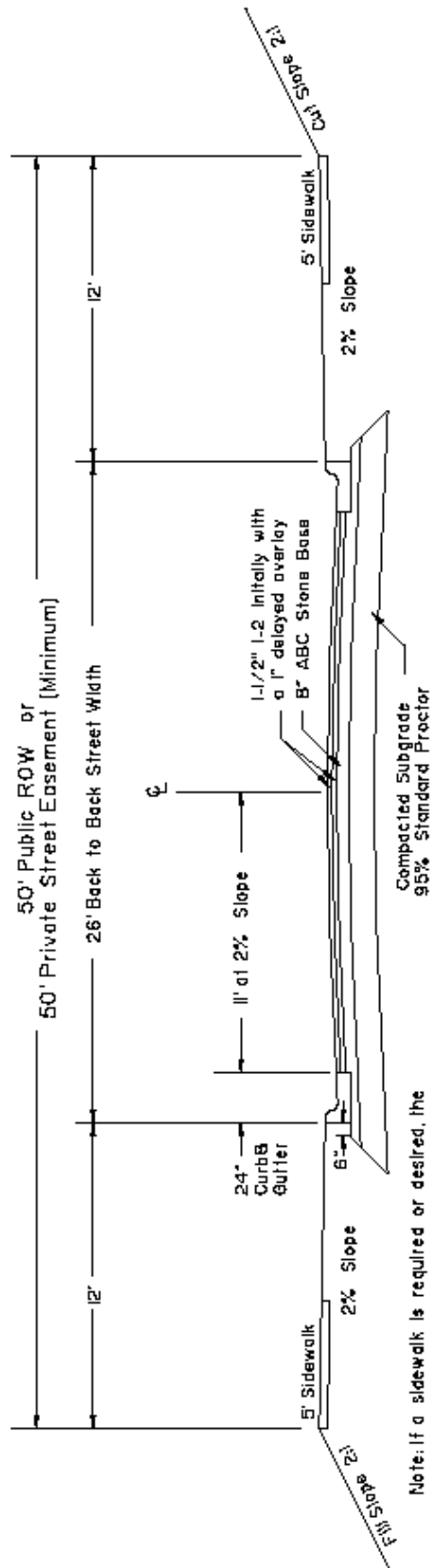
Note: If a sidewalk is required or desired, the location may vary. Additional easement width may be required. See Sidewalk Ordinance.

The diagram illustrates a 70-foot wide street cross-section, divided into two 35-foot halves by a centerline. The components and slopes are as follows:

- Outer Slopes:** 2% Slope on both the left and right sides.
- Shoulders:** 6' Shoulder on both sides, with a slope of 1" per foot.
- Travel Lanes:** 34' Slope on both sides.
- Centerline:** 4' Slope on both sides.
- Subgrade:** 3 1/2' Slope on both sides.
- Subgrade Slope:** 2% Slope on both sides.
- Subgrade Material:** Compacted Subgrade, 95% Standard Proctor.
- Base Course:** 3" Stone Base.
- Pavement:** 22" Strip Pavement, Slope = 1/4" per foot.
- Initial Pavement:** 1-1/2" L-2 Initially with a 1" delayed overlay.
- Stone Base:** 8" ABC Stone Base.
- Centerline Marking:** 1" (width of the centerline marking).

170

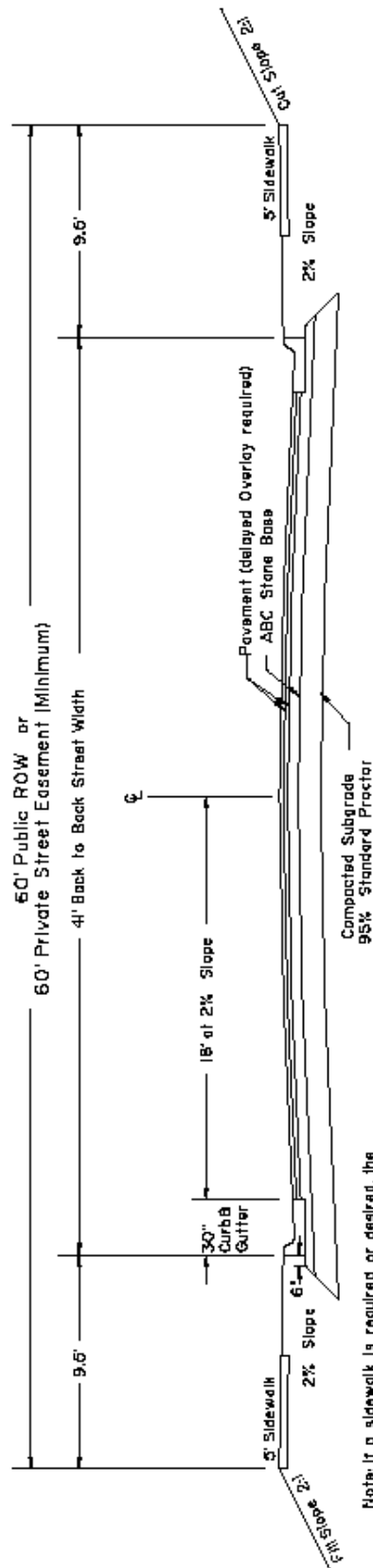
RESIDENTIAL MAJOR LOCAL STREET W/ CURB & RESIDENTIAL LOCAL STREET WITH CURB



Note: If a sidewalk is required or desired, the location may vary. Additional easement width may be required. See Sidewalk Ordinance.

Note: Roll Curb not acceptable in this section

COLLECTOR

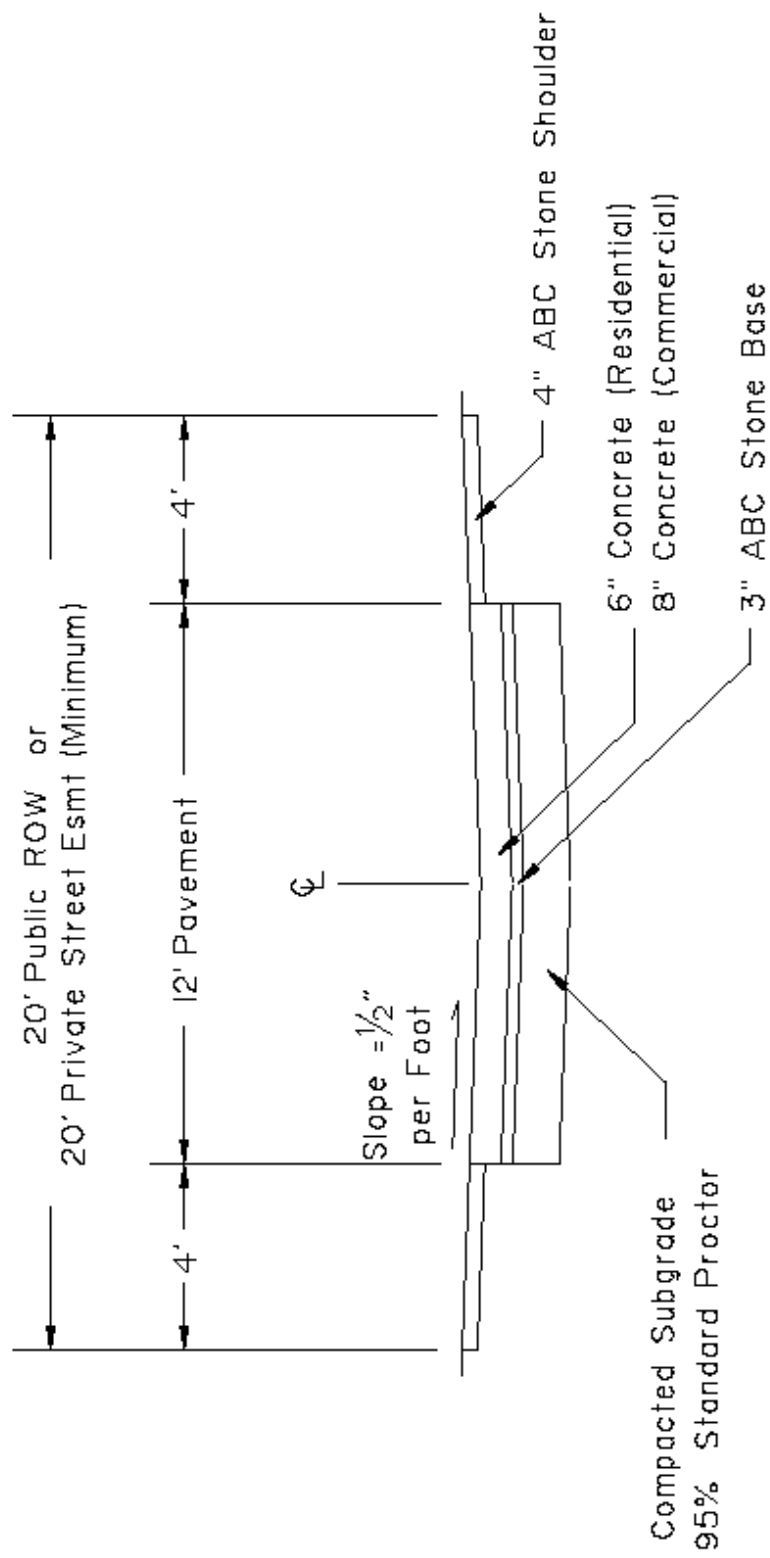


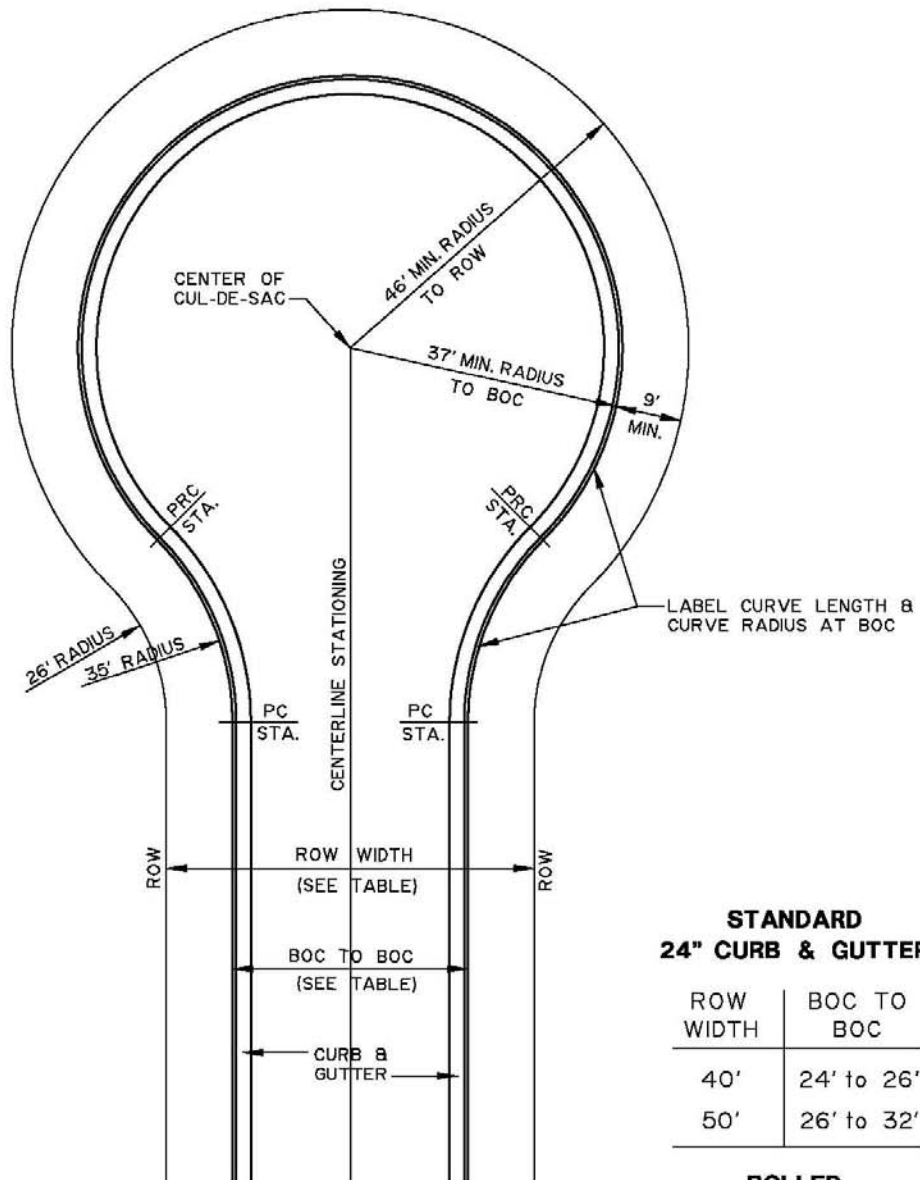
Note: If a sidewalk is required or desired, the location may vary. Additional easement width may be required. See Sidewalk Ordinance.

Note: Depths of pavement and stone base to be determined on a case by case basis.

Note: Roll Curb not acceptable in this section

ALLEY



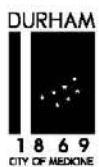


**STANDARD
24" CURB & GUTTER**

ROW WIDTH	BOC TO BOC
40'	24' to 26'
50'	26' to 32'

**ROLLED
30" CURB & GUTTER**

ROW WIDTH	BOC TO BOC
40'	23' to 25'



DATE:
AUG. 2003

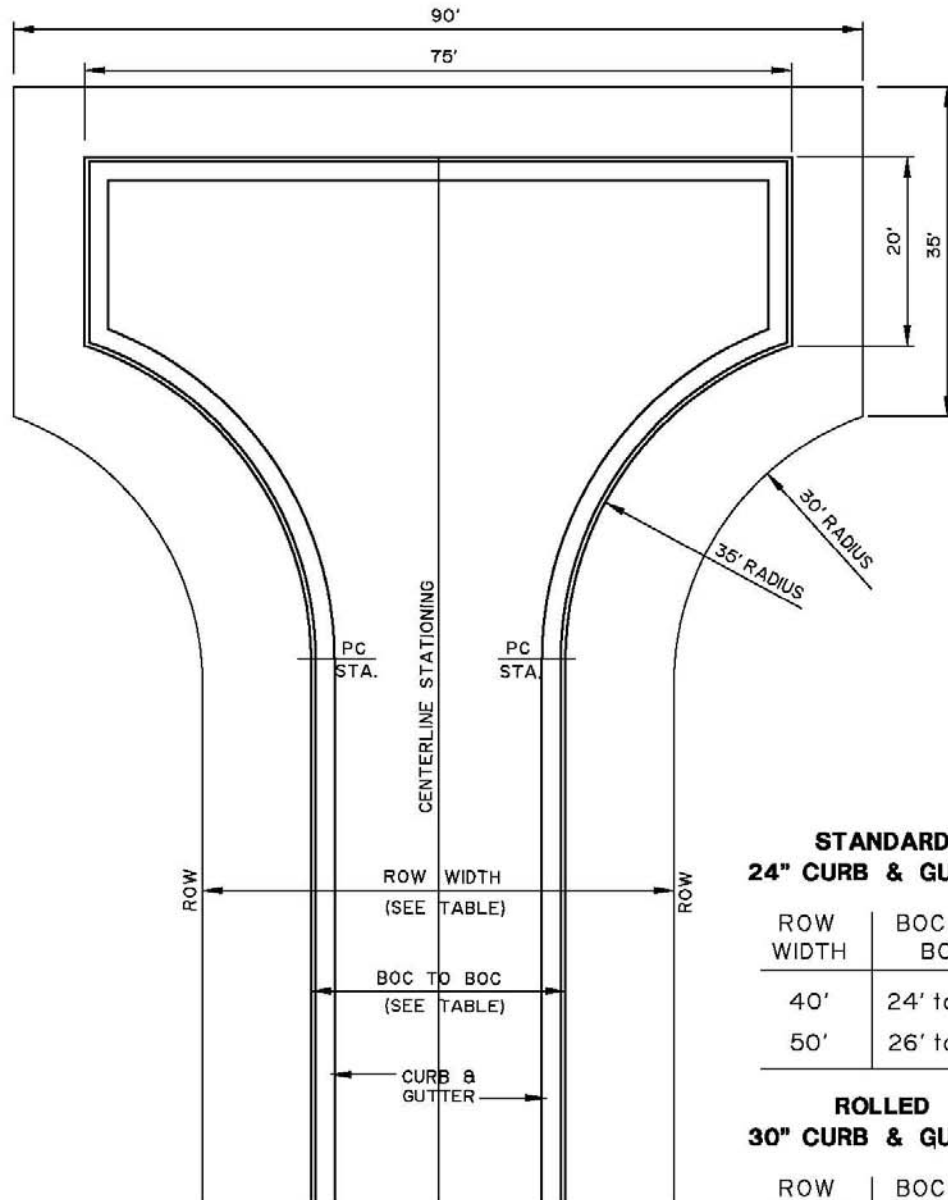
REVISED:

**RESIDENTIAL CUL-DE-SAC
WITH CURB & GUTTER**

CITY OF DURHAM, NORTH CAROLINA
DEPARTMENT OF PUBLIC WORKS

SCALE:
NONE

DETAIL NO.
ST-12



**STANDARD
24" CURB & GUTTER**

ROW WIDTH	BOC TO BOC
40'	24' to 26'
50'	26' to 32'

**ROLLED
30" CURB & GUTTER**

ROW WIDTH	BOC TO BOC
40'	23' to 25'



DATE:
AUG. 2003

REVISED:

**HAMMERHEAD CUL-DE-SAC
WITH CURB & GUTTER**

**CITY OF DURHAM, NORTH CAROLINA
DEPARTMENT OF PUBLIC WORKS**

SCALE:
NONE

DETAIL NO.
ST-14

Section 10.0

TRANSPORTATION

This section is intended to provide design criteria for street layout and vehicular movement. The Department of Transportation is responsible for reviewing and approving the general design layout of traffic flow patterns, for reviewing and approving the plans and installations of street name signs, traffic control signs and devices, traffic impact studies and street lighting.

For street types and sections available for public and private streets, construction plan and profile guidelines refer to Section 9.0, Streets.

Below is a list of items and corresponding Department or Division that can assist the designer if unable to locate the information in the Zoning and Subdivision Ordinance.

Item	Department/Division
1. Site Access	1. Planning; Zoning/Subdivision Ordinance, Fire Protection
2. Parking Spaces	2. Planning; for size, number of spaces
3. Parking	3. Public Works/Transportation; for layout, orientation
4. Entrance Location/width	4. Public Works/Transportation, Fire Protection
5. NCDOT streets (existing/future)	5. NCDOT
6. Cul-de-sacs length	6. Public Works/Transportation
7. Number of units served	7. Public Works/Transportation
8. Design Speed	8. Public Works/Transportation
9. ROW required	9. Public Works/Transportation
10. ROW; existing width	10. County Court House (plat/deed books
11. Sidewalk required	11. Public Works/Transportation
12. Sidewalk location, design	12. Public Works/Engineering
13. Pavement Designs	13. Public Works/Engineering
14. Curb and Gutter design	14. Public Works/Engineering
15. Construction details	15. Public Works/Engineering
16. Street Construction Plans	16. Public Works/Engineering
17. Current Street Maintenance	17. Public Works/Engineering Services ; NCDOT
18. Bus routes	18. Public Works/Transportation

Section I. Layout

The purpose of these street standards is to create safe, livable, attractive streets. Streets are not used for a single purpose, but for multiple purposes. Properly designed streets provide access and mobility, corridors for pedestrian, bicycle, transit and motor vehicle movement, fire and emergency vehicle access, attractive public spaces, a place for neighborhood interaction, the efficient provision of public utilities networks including water supply, sanitary sewer, electricity, telecommunications and gas services, refuse disposal and for delivery of postal and other services. Properly designed streets create attractive communities and contribute to clearly defined sense of place. Streets shall be designed with due attention to building spacing and setbacks, and green spaces. A street should be designed according to its function. The street pattern shall provide acceptable levels of accessibility, safety and convenience for all street users in residential areas, while meeting community urban design requirements. The pattern should discourage residential streets from operating as through traffic routes for externally generated traffic, while limiting the length of time local drivers need to spend in a low-speed environment. The neighborhood street pattern should be simple, and logical, with the following characteristics exhibiting connectivity:

- a. minimize excessive vehicular traffic and discourage inappropriate through traffic
- b. conforming with the thoroughfare plan and/or other adopted corridor plans
- c. fit with and complement pedestrian, bicycle and transit networks.

The design of the streets is intended to promote appropriate vehicular speeds on local neighborhood streets and reasonable access requirements for emergency vehicles. Streets should be designed to reduce the potential for excessive speeds. Traffic calming elements may be necessary to accomplish this goal.

Section II. Signage and Pavement Marking Requirements

The developer is responsible for fabrication and installation of all required standard street name signs, traffic control signs, poles and pavement markings within the public right-of-way. The developer shall submit a signing and markings plan to the City at construction plan stage for review and approval. All signs and pavement markings, shown on the construction plans, must be in place prior to the issuance of any certificate of occupancy. The developer will maintain the signs, poles and markings until the street is accepted by the City of Durham, where from there, the City or NCDOT will maintain the signs, poles and markings at no additional cost to the developer.

If decorative (non-standard) street lighting, signs or poles are desired, the City may permit the developer to install the decorative (non-standard) items if they meet the minimum requirements set out in the Manual on Uniform Traffic Control Devices, the City of Durham Street Lighting Policy, and the IES (Illuminating Engineering Society) Applicable Standards. **Designs and locations of decorative items must be approved by separate agreement with the City of Durham Transportation Division.**

Criteria

1. All signage installed shall conform to standards set forth by the latest published edition of the Manual on Uniform Traffic Control Devices (MUTCD), the North Carolina Department of Transportation (NCDOT) Standard Construction Drawings, and City of Durham standards.
2. Signage material shall conform to MUTCD color and reflectivity standards and shall at a minimum be engineering grade reflective material, except stop signs. Stop signs shall be constructed of hi-intensity grade material on a 30-inch by 30-inch octagonal stop sign blank.
3. All signs, except street markers, shall be mounted in a manner that the bottom of the sign is a minimum of 7-feet above ground level. Street marker signs shall be mounted over the top of stop signs according to the street marker standards in **7.** below.

4. Ground mounted sign posts used to install street signage shall be 12-feet long and constructed of 14 gauge galvanized steel “U” channel posts or two inch (2-in) galvanized square steel tubing. When used in specific locations and directed by the City of Durham, colored ground mounted sign posts may be required to match existing streetscape in the project vicinity. Colored ground mounted supports shall be steel with a powder coated finish. All ground mounted sign posts shall have 3/8th-inch holes down the center of the post drilled at 1-inch spacing for the entire length of the post.
5. Ground mounted sign posts shall be driven to a minimum of 30-inches below ground level. All posts shall be plumbed and leveled as the post is installed.
6. If decorative (non-standard) items (poles, signs, etc.) are installed, it will be the responsibility of the developer to fabricate the items, install the items, and enter into an agreement with the City of Durham for the maintenance.
7. All street markers (street name signs) shall be designed and installed as follows:
 - a. Street markers shall be installed at all street intersections and will include the block number of each street
 - b. All signage provided and installed shall be constructed from a 0.080 gauge anodized aluminum sign blank and conform to standard MUTCD sign sizes.
 - c. Street markers shall be designed in a stacked configuration and located in a manner for visibility from all directions of travel.
 - d. Street names shall be displayed by using a minimum of 4-inch reflective white letters and 2-inch reflective white numbers for the block numbers and abbreviations (RD, DR, etc.) on a reflective green background. On private streets, a notation of "private street" in 2-inch black letters on a yellow background will be added on the edge of the sign closest to the road. Signs must not have borders.
 - e. The layout of the street markers shall conform to the City of Durham standard drawings. The street name shall appear centered vertically on the left of the street marker. The abbreviation shall appear to the top right of the street marker. The block number shall appear to the bottom right of the street marker. Each item should be spaced to balance the appearance of the street marker.
 - f. Street marker material shall conform to MUTCD color and reflectivity standards and shall at a minimum be engineering grade reflective material.
 - g. The letters shall be designed using the Standard Highway Alphabet of FHWA, series B.
 - h. 2 sign blanks are required for each street name marker assembly. Each blank shall have a street name on both sides. The sign blanks shall be installed in a stacked manner using commercially available aluminum mounting hardware. Each assembly shall contain 1 cross mount for flat blade street signs and 1 U-channel or square post bracket for flat blade street name signs. Street markers for different streets shall be placed at right angles (see City of Durham standard drawings for street marker sign and street marker assembly construction). The street marker assembly shall be mounted to the U-channel or square post over the top of the stop signs. If a stop sign is not present, or the stop sign is not at an appropriate location for street markers, street markers shall be mounted on a separate u-channel or square post at the appropriate location.
 - i. The length of the street marker is variable depending on the length of the street name, but should conform to Table 1 below. The height of the street marker shall be 6-inches.

Table 1

Street Marker Blank Length

Street Name – Number of Letters*	Street Marker Blank Length
3-7 letters	24-inches
8-10 letters	30-inches
11-13 letters	36-inches
Above 13 letters	36-inches plus 2-inches per additional letter

* Number of letters refers to the name of the street, but not the abbreviations needed to label road, drive, avenue, street, etc.

8. Pavement markings shall be placed on the streets adjacent to the site where roadway improvements are required or will be placed on new streets to be accepted by the City of Durham. Pavement markings must be made of a thermoplastic material and adhere to section 1200 of the NCDOT Roadway Standard Drawings, 2002 edition.

Checklist for the Signing and Pavement Marking Plans:

- _____ Note that signs and markings must be installed prior to certificate of occupancy and/or street acceptance, as determined by the City
- _____ Stop signs/street markers
- _____ No outlet signs
- _____ Speed limit signs (**25-mph signs will be installed on streets that are more than 800-feet in length in subdivisions where needed**)
- _____ Speed hump signs/markings
- _____ Stop bars (24-inch white thermoplastic)
- _____ Details of signs, spacing from ground, etc
- _____ All signs conform to the Manual On Uniform Traffic Control Devices (MUTCD) unless otherwise noted
- _____ Standard notes
- _____ Crosswalk Pavement Markings
- _____ Dimensions of Storage Bays, Bay Tapers, Transitions, Lane Widths, Crosswalks, etc.
- _____ All Permanent Pavement Markings Shall Be Thermoplastic
- _____ Details or Reference to NCDOT Standard Drawings
- _____ Any Site Specific Notes
- _____ Labeling of All Markings (Existing and Proposed)
- _____ Other things: To be determined

Standard notes

For site plan:

Add the following note to the Special Conditions of Approval Box: “The developer is responsible for fabrication and installation of all required signs and pavement markings within the public right-of-way. The developer shall submit a signing and markings plan to the City at construction plan stage for review and approval. All signs and pavement markings, shown on the construction plans, must be in place prior to the issuance of any certificate of occupancy and/or street acceptance, as determined by the City.”

For construction drawings (signing and pavement marking plan):

1. All signs, street markers, and pavement markings (everything called out on the signing and marking sheet) must be installed on each street prior to the issuance of a certificate of occupancy and/or street acceptance, as determined by the City.
2. The street name sign shall be reflective to show the same shape and similar color both day and night. The letters and background shall be of contrasting colors.
3. Street name signs shall have white letters on a green background.
4. Lettering on the street names shall be 4-inch high in capital letters.
5. Suffix lettering to indicate the type of street (such as street, avenue, or road) or the section of the City (such as NW) shall be lettering 2-inch high.
6. Street name signs will be located on top of stop signs in a stacked position.
7. Stop bars shall be 2-feet wide white thermoplastic per NCDOT specifications.

8. All signs must conform with the Manual On Uniform Traffic Control Devices (MUTCD).
9. Street signs shall show block numbers. (Block numbers are shown on the recorded plat. If they are not shown on recorded plat, contact the City's Engineering Assessments Division at 560-4326)

Section III. Lighting Requirements

The City of Durham, at no additional cost to the developer or property owners, provides standard street lighting within the corporate City limits on City maintained streets. Street lighting is installed at all intersections and non-occupied cul-de-sacs. When requested by petition, extended street lighting may be installed in occupied cul-de-sacs and along the street blocks with an approximate spacing of 140-feet. The extended street lighting will be provided when budgeted funds are available.

The standard street light provided by the City of Durham is 9500 lumen, nema head, high pressure sodium unit mounted on a wooden pole at a minimum height of 20-feet.

A developer or legal home owner's association may elect to install decorative (non-standard) street lighting. This may be accomplished by ordering the non-standard lighting through the local utility company serving the area. At locations the City would have automatically installed the standard street lighting, the City may participate in the cost of the monthly electrical fees. Developers and associations considering this option are cautioned to consider possible problems with future maintenance.

Section IV. Guidelines for Traffic Impact Analysis (TIA)

Requirement:

A Traffic Impact Analysis (TIA) is required if the proposed development is expected to generate 150 or more peak hour vehicle trips as determined by the ITE Trip Generation Manual, most recent edition. The TIA must be of sufficient scope and detail to allow the City to evaluate the impact of the proposal and the need for roadway capacity, operation and safety improvements resulting from the proposed development. Supplemental analysis may be required if there is a change in the development plan, site plan or land use. A TIA is valid as long as the approved site plan or development plan associated with the TIA is deemed valid.

Preparer:

The report shall be prepared by a professional engineer who is registered in North Carolina and has expertise in traffic engineering.

Analysis Period:

The analysis must examine expected traffic conditions one year after the project is scheduled to be complete.

Pre-Submittal Conference:

Prior to submitting the TIA, the traffic engineer must consult with the City Transportation Division to discuss various assumptions for the study, including, but not limited to: trip generation assumptions, other approved developments within the study area, study area limits, trip distribution and pass-by traffic. This discussion may be accomplished via phone, e-mail or fax or in person. TIAs submitted without a pre-submittal conference may be rejected.

Memorandum of Understanding:

The traffic engineer shall submit a memorandum of understanding to the City Transportation Division to document the agreements made during the pre-submittal conference. The memorandum of understanding may be received by the City via e-mail, fax, or mail. The traffic engineer shall not begin work on the TIA until the City Transportation Division has approved the memorandum of understanding.

Trip Generation:

Trip generation estimates must be obtained from the latest version of the ITE Trip Generation Manual. The standard trip generation estimates to be used are those for the AM and PM peak hours of adjacent street traffic on a weekday. Exceptions to this may include churches, recreation facilities or other special generators. ITE procedures for generating traffic shall be used as specified in the Trip Generation Manual. Alternate rates may be used with prior approval by City Transportation staff. Any assumption regarding site traffic distribution or demand reduction via pass-by trips, internal trips, transit usage or transportation demand management (TDM) strategies, must be approved in advance by the City Transportation staff and documented in the report. Include documentation calculations (i.e. rates or equations used for each land use) in the report.

Trip Distribution and Assignment:

Sketches of site traffic distribution percentages must be included. An accompanying trip assignment sketch should clearly indicate turning movements attributable to the project site at the analysis intersections.

Area of Analysis:

The analysis area should include all streets where site traffic will constitute 10% or more of any intersection approach during the peak hour. Current intersection turning movement counts must be obtained unless recent counts (within the last twelve months) are available from the City or NCDOT. All turning movement counts utilized must have been collected within the twelve months prior to the date of submittal and on weekdays (excluding Monday AM and Friday PM peak hours and holidays). Other peak periods such as noon or weekend periods, may be required if appropriate for the development. Efforts should be made to balance traffic volumes between closely spaced intersections where appropriate. City Transportation staff may require signal warrant analyses for high volume un-signalized intersections. The analysis must follow the warrant guidelines specified in the latest edition of the Federal Highway Manual of Uniform Traffic Control Devices (MUTCD).

The analysis may include recent crash data in the study area. The report should identify locations where traffic safety should be given extra consideration.

Approved Development Traffic:

As listed below, traffic from other nearby significant approved developments must be included in the analysis. Analysis of traffic from pending development projects with significant trip generation potential may also be required at the discretion of the City. Traffic volumes for any approved developments can be obtained from the City's Transportation Division.

Improvements:

Improvements which may be assumed in the analysis are those which have an expected completion date concurrent with that of the project and are either:

1. Funded in the City's Capital Improvement Program,
2. Funded through the State's Transportation Improvement Program, or
3. Indicated as required improvements of other approved development projects.

Those improvements related to other development projects must be clearly referenced in the report. Prior approval must be obtained from City Transportation staff to include other roadway improvements.

The study should clearly indicate those improvements offered by the developer to improve safety or operations. The goal is to achieve LOS D, ensure proper traffic operations, and mitigate potential safety concerns. Where existing conditions are below LOS D, improvements must be recommended that, at a minimum, attain LOS D unless otherwise approved by City staff.

Analysis Required:

The study shall be performed using the operational analysis of the latest Highway Capacity Manual and its associated software (Synchro HCM Reports may be substituted for HCS). Other software packages such as Synchro are preferred for coordinated signal systems and may be required for supplemental analysis. All signalized intersections within the analysis area, all project entrances, and all un-signalized intersections at which site traffic will constitute 10% or more of any one approach shall be modeled. Due to related impacts or current operational problems, the Transportation Division may require other adjacent intersections to be included in the study area. Safety, traffic simulation, gap, queue, traffic signal warrants or other analyses may also be required under certain circumstances.

If a signal is part of a coordinated system, it must be analyzed as such under all scenarios. It is acceptable to optimize all signals for future alternative analyses, however present signal timings and phasing shall be used for the existing conditions analysis. The following assumptions shall be used unless City Transportation staff grants prior approval for variance. Supporting data may be required.

- A peak hour factor of 0.90 shall be applied for all cases except existing traffic.
- Zero right turns on red for signalized intersections as a worst-case scenario.
- Type III arrival rate.
- Minimum four (4) second yellow and two (2) second all-red clearance interval.
- Minimum seven (7) second green time per phase for left turns.
- Minimum ten (10) second green time for through movements.
- Preferred Signal Cycle Lengths:
 - Two or Three Phase = 60 second minimum, 120 second maximum
 - Four to Eight Phase = 110 second minimum, 180 second maximum

Intersections shall be analyzed under four scenarios:

1. Existing
2. No-Build (existing + 3% annual growth + approved developments)
3. Build (existing + 3% annual growth + approved + site traffic)
4. Build Improved (existing + 3% annual growth + approved + site + necessary improvements)

Scenario 4 may be eliminated if improvements are not necessary to satisfy any queuing problems or the LOS criteria listed herein. Overall LOS must be provided for all signalized intersections and worst movement LOS must be provided for all unsignalized intersections. Intersection analysis shall include queue analysis. The analysis year for all future scenarios is one year following the development's scheduled completion year (Build + 1).

Report Content:

Two copies of the final report should be submitted to the City Transportation Division, one copy shall be submitted to the City Planning Department, and if necessary, copies relating to projects impacting state roads should be submitted to the NCDOT District Office as well as the NCDOT Traffic Engineering Branch.

The report must include:

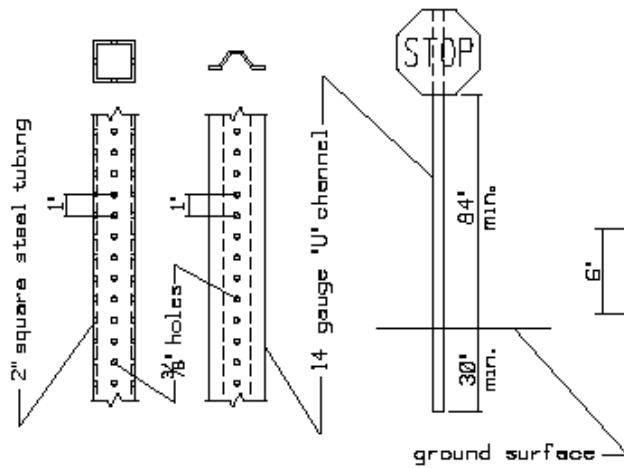
- A full size copy of the site/development plan, (If the site plan had a development plan preceding it, then the site plan must be consistent with the official development plan submitted to the City-County Planning Department.)
- A vicinity map,
- Speed limits of streets within the study area,
- Sketches of traffic distribution percentages and peak hour volumes,
- All capacity analyses (detailed report),
- Signal warrant studies, if appropriate,
- Intersection diagrams, which, as a minimum shall indicate:
 - The current approach and departure laneage at each intersection,
 - The distance between adjacent intersections,
 - The length of full width storage and departure for existing auxiliary lanes,
 - Recommended storage for proposed auxiliary lanes,
 - Any mid-block changes in cross section should also be noted, and
- Other documentation of data and assumptions used in the analysis.

Any submittal not containing all of the above elements will be considered incomplete and shall not be reviewed until a complete submittal is received.

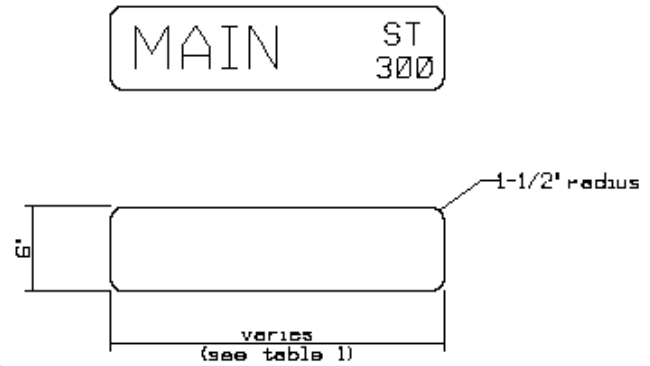
The report must clearly indicate those improvements proposed by the developer. For multi-phase developments, the phasing of improvements should be addressed. Capacity analyses may be required to confirm that the phasing of improvements will provide an acceptable level of service with each phase.

Attached are pages that illustrate the preferred outline (table of contents) for all TIA reports submitted to the City along with the Review Checklist used by City of Durham officials. See attachments.

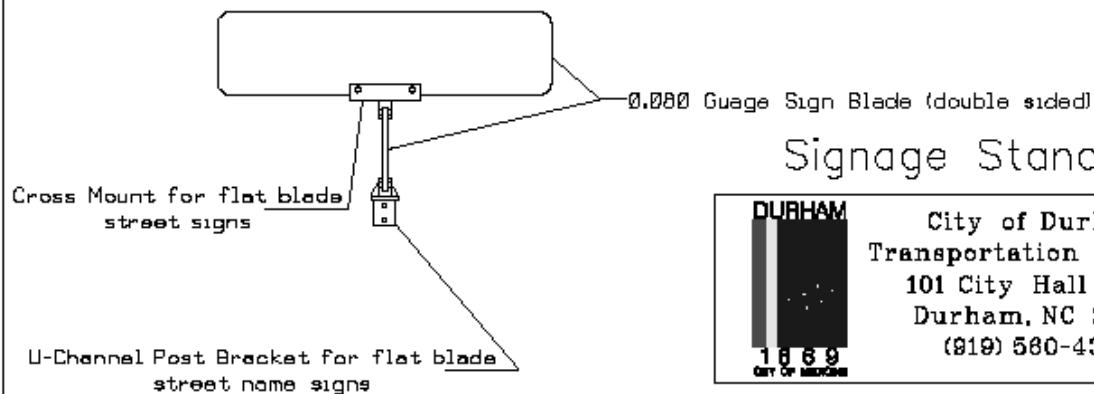
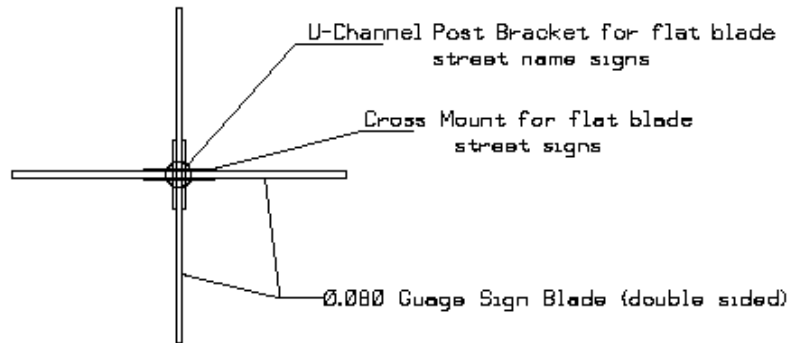
General Signage



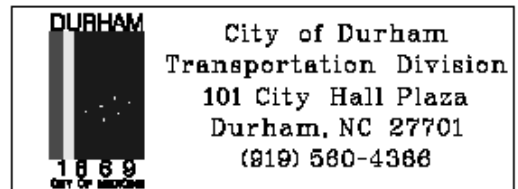
Street Marker Signage



Street Marker Assembly



Signage Standard



TIA Attachment #1 - Standard Table of Contents
FOR TIA REPORTS SUBMITTED TO THE CITY OF DURHAM

1. Introduction

2. Executive Summary

3. Site Location and Access

- Figure: Vicinity Map
- Figure: Site Plan Map
- Figure: Existing Lane Geometry of Study Intersections (*include current approach and departure laneage at each intersection, distances between intersections, speed limits, and full width storage for exclusive turn lanes*)

4. Existing Analysis

- Figure: Existing AM and PM Turning Movement Volumes
- Table: Existing LOS Results (*Overall LOS indicated for signalized intersections and Worst Movement/Approach for unsignalized intersections*)

5. Future No-Build Analysis

- Figure: No-Build AM and PM Turning Movement Volumes
- Table: No-Build LOS Results (*Overall LOS indicated for signalized intersections and Worst Movement/Approach for unsignalized intersections*)

6. Trip Generation

- Table: Trip Generation Rates (*Land use and quantity, ITE Code, and resulting ADT volumes, AM and PM Enter and Exit volumes included*)

7. Trip Distribution and Assignment

- Figure: Directional Distribution Percentages
- Figure: Site Generated Trip Assignment

8. Future Build Analysis

- Figure: Build AM and PM Turning Movement Volumes
- Table: Build LOS Results (*Overall LOS indicated for signalized intersections and Worst Movement/Approach for unsignalized intersections*)

9. Future Build Improved Analysis (*Not required if no improvements are necessary*)

- Figure: Build Improved AM and PM Turning Movement Volumes
- Table: Build Improved LOS Results (*Overall LOS indicated for signalized intersections and Worst Movement/Approach for unsignalized intersections*)

10. Supplemental Analysis (Safety, Signal Warrant, Queue, or other analysis as required)

11. Findings and Conclusions

- Table: LOS Comparison of All Scenarios (*Overall LOS indicated for signalized intersections and Worst Movement/Approach for unsignalized intersections*)
- Figure: Roadway Lane Configurations (*Existing, Proposed, and Committed Improvements Indicated, with accompanying identification of parties responsible for improvments*)

**TIA Attachment #2 -Traffic Impact Assessment
Review Checklist**

Development Name : _____
Development Location : _____
Development Owner : _____
TIA Prepared by : _____ Company : _____
Site Plan Prepared by: _____ Company : _____
Review Date : _____ Reviewed By : _____

Submittal Package:

- _____ Full size copy of the site / development plan
- _____ Plans Sealed
- _____ TIA Sealed
- _____ Vicinity map
- _____ Speed limit(s) of streets within the study area
- _____ Sketch of traffic distribution percentages
- _____ Sketch of peak hour volumes
- _____ Capacity Analyses
- _____ Signal Warrant Study (if applicable)
- _____ Documentation of Data and Assumptions (traffic counts, trip generation, safety)
- _____ Intersection diagrams, including
 - _____ Approach laneage
 - _____ Departure laneage
 - _____ Distance between adjacent intersections
 - _____ Length of full-width storage in existing auxiliary lanes
 - _____ Recommended storage for proposed auxiliary lanes
- _____ Improvements proposed by developer clearly noted
- _____ Multi-phase development?
 - _____ Phased improvements addressed?
 - _____ Capacity analysis for phased improvement provided?

General Requirements:

- _____ Operational analysis performed using Highway Capacity Software / Synchro
- _____ All project entrances analyzed
- _____ All signalized intersections within study area analyzed
- _____ All un-signalized intersections where site traffic will constitute 10% or more of any one approach.
- _____ Other intersection analysis required??
 - Which intersection(s): _____
 - _____
 - _____

Assumptions:

- _____ Peak hour factor of 0.9
- _____ Type III arrival rate
- _____ Minimum 6-second yellow + all red clearance
- _____ 7-second minimum green time per left turn movement
- _____ 10-second minimum green time per left through movement (speed limit)

Scenarios Analyzed:

- _____ Existing traffic
- _____ No Build (Existing traffic + 3% annual growth + approved development traffic)
- _____ Build (Existing traffic + 3% annual growth + approved development traffic + site traffic)
- _____ Build Improved (Existing + 3% annual growth +approved development traffic+ site traffic+ necessary improvements)

Detailed Review Comments:

Existing Traffic Volumes: Are the existing counts based on recent peak hour turning movements? If older data were used, have they been updated using reasonable factors (agreed to by the City)? Are the seasonal and day of the week representative of the year or design year? Was construction or any other events that might have impacted the validity of the counts noted? _____

Comments:

Trip Generation: Are the project trip generation rates from the latest edition of ITE’s Trip Generation? If yes, are the rates based on a sufficient number of studies to be accurate and used correctly? If local trip generation rates are used, such as from similar developments in the area, is there adequate documentation to support the rates? _____

Comments:

Reduction in Trip Generation: Are any trip reductions used for Pass-By Trips, Internal Capture Traffic, Transit, Ride-Sharing, etc. reasonable? Are reductions adequately documented? Is the source and rationale for reductions valid for this application? Is the full impact of turning movements addressed? _____

Comments:

Trip Distribution / Assignment: Are the expected trip patterns to / from the subject site reasonable based on a market analysis, existing patterns, population distribution, or a network traffic assignment model, etc.? _____

Comments:

Background Traffic: Is there a reasonable projection of non-project traffic on the nearby street system for the horizon year based on historic increases and consideration of approved projects in the vicinity? Are these volumes shown graphically? _____

Comments:

Analysis: Are the correct time periods evaluated – i.e. AM peak hour, PM peak hour, daily / weekend peaks at shopping centers, recreational uses, etc.? Are levels of service shown for each movement at the study area intersections? Has the study addressed all issues from pre-study meetings / conferences / transmittals, etc.?

Comments:

Access: Are the number of driveways proposed the minimum needed to accommodate site traffic? Could conditions be improved with some sort of shared access system or relocation of access points? _____

Comments:

Mitigation Alternatives: If the study acknowledges that improvements to the roadway system will be needed, are the proposed mitigation alternatives reasonable and implementable?

Comments:

Mitigation Timing: Are the timing and responsibility for implementing mitigation measures addressed sufficiently? Are there any recommended roadway improvements which are not addressed? _____

Comments:

Review Meeting: Is there a need for a joint meeting between the City, community representatives, adjacent communities, others, and the developer to discuss traffic issues related to this project prior to any approval?

Comments:

SECTION 11.0

SIDEWALKS

This section is intended to provide design criteria for sidewalk layout and construction.

I. General

1. Sidewalk plans shall be to conditions as shown on site plan or field adjusted.
2. Add the following note for the proposed sidewalk located within the ROW;

The location of the sidewalk shown on this plan is schematic. A City of Durham and /or NCDOT encroachment permit is required prior to any construction. After obtaining the required permits, please contact the City of Durham Engineering Construction Inspection office at 560-4326 for a pre-construction conference and field visit prior to any work on the proposed sidewalk.

3. Sidewalks are to be constructed inside and adjacent to the right-of way.
4. Sidewalks shall extend to all intersections (even crossing roadside ditches).
5. All sidewalks at intersections to have handicap ramps according to the City of Durham details and specifications. At NCDOT roads, two ramps at each corner.
6. Sidewalks shall be a minimum of 4-inches thick and 6-inches thick across driveways.
7. Sidewalks shall be a minimum of 5-feet wide.
8. If a meter is installed in the sidewalk, then the meter shall be installed at the back of sidewalk or can be installed in the sidewalk providing the water meter box top is flush, smooth and is not a tripping hazard.
9. Public sidewalks will have no wire reinforcing.
10. Sidewalks to extend across all driveways (6-inches thick).
11. All handicapped ramps shall be 6-inches thick.
12. The sidewalk and handicap ramp from PC to PT through a radius shall be 6-inches thick.
13. Sidewalks shall be 3,000-psi concrete.
14. Sidewalks at the back of curb shall be a minimum of 6 feet wide and 6 inches thick.
15. Payment in lieu for sidewalk construction may be an option for sites if it can be demonstrated to the approving body that such construction may cause undo construction hardship (culverts, bridges, etc.). The hardship must be demonstrated before a plan is submitted with the payment in lieu note on the plan. A request should be submitted in writing prior to the City/County Planning Department's Development Review Board's (DRB) consideration. DRB must grant approval of this option during review of the site plan.
16. On major and minor thoroughfares within the UGA, sidewalks must be placed on both sides of the road. All other roads within the UGA, sidewalk must be placed on at least one side of the road. The Transportation Division, at its own discretion, may require that sidewalks be constructed on both sides of roads in heavy commercial, heavy retail or heavy residential areas. On all site plans, sidewalk must be designated as so whether it is existing sidewalk or proposed sidewalk.
17. Sidewalks shall be placed as directed by the Engineering Division at an elevation that corresponds with future widening such that the sidewalk will not need to be replaced when future widening takes place.

SECTION 12.0

STANDARD NOTES

This section contains the most commonly used notes and easement phrases. Some of the dimensions are left blank since it is a variable number. Refer to the Durham City/County Zoning Ordinance or the UDO, as applicable, for the requirements of these dimensions.

Engineering Division Notes

Engineering Standard Site Plan Notes. In the Special Conditions of Approval Box, always add the following notes:

All sizes, materials, slopes, geometry, locations, evaluations, extensions and depths for all existing and proposed streets and utilities (waterlines, sanitary sewer lines and storm drainage conveyance systems) shall be designed to the specifications set forth in the design criteria and standards of the Public Works Department and be subject to review and approval by the Public Works Department at construction drawing submittal.

The designing professional (a NCPE, NCPLS or NCRLA – as required) will submit 3 sets of construction drawings to City Engineering for review and approval before starting construction (see Construction Plan Approval Process).

NOTE: The approval of construction drawings is separate from site plan approval.

As-built drawings shall be approved prior to water meter and sanitary sewer service connection installations and prior issuance of a certificate of occupancy.

In the Special Conditions of Approval Box, add the following notes as required:

Extension Agreement required (submit after site plan approved but before construction plans). Contact Engineering Division (560-4326, FAX 560-4316) with complete name (Individual, Inc., Corp., etc) and telephone number of entity extending services to the site.

Annexation petition required. Contact Budget Department @ 560-4111

If a hydrant is proposed a fire flow analysis is required. Waterline size may change with fire flow analysis. Contact City Engineering @ 560-4326 to schedule flow test or to obtain current system data.

Water and sanitary sewer permits are required for this project.

Back flow permit required with this project.

A City of Durham Driveway permit is required.

A NCDOT or City of Durham Driveway Permit is required.

Water easement note:

Centerline of _____ foot wide City of Durham Water Easement. Subject to terms stated in the Declaration in Real Estate Book 1510, page 958. No structures, fill, embankments, trees or obstructions permitted within the easement except according to those terms.

Sanitary sewer easement note:

Centerline of _____ foot wide City of Durham Sanitary Sewer Easement. Subject to terms stated in the Declaration in Real Estate Book 1510, page 958. No structures, fill, embankments, trees or obstructions permitted within the easement except according to those terms.

Centerline of _____ foot wide County of Durham Sanitary Sewer Easement. Subject to terms stated in the Declaration in Real Estate Book 1626, page 145. No structures, fill, embankments, trees or obstructions permitted within the easement except according to those terms.

Sidewalk note:

The location of the sidewalks shown on this plan is schematic. A City of Durham and/or NCDOT encroachment permit is required prior to any construction. After obtaining the required permits, please contact the City of Durham Engineering Construction Inspection office at 560-4326 for a pre-construction conference and field visit prior to any work on the proposed sidewalk.

Driveway permit notes:

A City of Durham Driveway Permit is required prior to any driveway construction on public right-of-way. Submit plans for Driveway Permit approval to City Engineering Development Review. After obtaining the permit, please call City of Durham Engineering Inspection office at 560-4326 prior to start of construction.

NCDOT Driveway Permit required prior to construction. Contact NCDOT at 220-4750 for requirements.

Utility Notes:

A Utility Mainline Construction permit is required prior to the installation of each utility. All utilities shall submit plan drawings and applications to the City Engineering Division.

Water service abandonment:

Abandonment of water services shall include excavating down to corporation, turning it off and cutting service line free from corporation. The meter, if present, shall be returned to City of Durham.

Sanitary sewer service abandonment:

Abandonment of sanitary sewer service lines shall consist of excavating down to the service connection to the main, cutting this connection and installing a watertight plug in the main. All clean-out risers on the service line should be removed. The service line can be abandoned in place.

Provide Utility Crossing Construction note where there are new mainline (public or private) utilities proposed on plans as follows:

Water, sanitary sewer and storm sewer separation notes:

1. *Horizontal and Vertical Separation*

- A. *Sanitary Sewers shall be laid at least 10-feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the City of Durham may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow the installation of the sanitary sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sanitary sewer and at an elevation so the bottom of the water main is at least 18-inches above the top of the sewer.*
- B. *If it is impossible to obtain proper horizontal and vertical separation as described above or anytime the sanitary sewer is over the water main, both the water main and sanitary sewer must be constructed of ferrous pipe complying with the public water supply design standards and be pressure tested to 150-psi to assure water tightness before backfilling.*
- C. *A 24-inch vertical separation shall be provided between storm sewer and sanitary sewer lines or ferrous pipe specified. A 12-inch vertical separation shall be provided between storm sewer and water mains.*
 - 1. *If a 12-inch vertical separation is not maintained at a crossing between storm sewer and water mains (or pressure sewers). The water main shall be constructed of ferrous pipe and a concrete collar shall be poured around water mains and storm sewer to immobilize the crossing.*

2. *Crossings*

- A. *Sanitary Sewer crossing water mains shall be laid to provide a minimum vertical distance of 18-inches between the outside of the water main and the outside of the sanitary sewer. The crossing shall be arranged so that the sanitary sewer joints will be equidistant and as far as possible from the water main joints.*
- B. *When it is impossible to obtain proper horizontal and vertical separation as stipulated above, one of the following methods must be specified.*
 - 1. *The sanitary sewer shall be designed and constructed of ferrous pipe and shall be pressure tested at 150-psi to assure water tightness prior to backfilling, or*
 - 2. *Either the water main or the sanitary sewer line may be encased in a watertight carrier pipe, which extends 10-feet on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be of materials approved by the City of Durham for use in water main construction.*

Townhome Note:

Townhome developments may be designed and constructed with parking areas on both sides of the travel lanes. This configuration is not to be considered a street. If this option is used, the travel and parking areas shall be noted as “Private Access and Common Areas”. As such, the Developer shall acknowledge and make prospective buyers aware that these areas will not be assigned a street name, nor will they ever be eligible for maintenance by the City of Durham. The Developer will ensure that all of the access and common area property is described in the covenants and that the Home Owners Association is responsible for the maintenance of this area. The following note shall be added to all site plans and plats associated with the development:

The driving and parking areas shown on this drawing noted as “Private Access and Common Areas” do not meet City of Durham street standards. The features within this area are private and will never be eligible for public maintenance.

Stormwater Services Division Notes

A. Special Conditions of Approval Box Notes for Site Plan/Preliminary Plat Submittals: (Note that these notes may or may not apply to the project depending on the requirements of the project, determined during review)

1. FEMA Flood Study Required:

“A CLOMR shall be obtained from FEMA prior to construction drawing approval. A LOMR shall be obtained from FEMA prior to issuance of any certificates of occupancy or certificates of compliance.”

2. For Developments within the Neuse River Basin (Payment, if required, to be determined during site plan review):

“A site plan cannot be approved until a receipt from the North Carolina Ecosystem Enhancement Program has been received by the City of Durham confirming the payment of \$X.XX in offset fees.”

3. For Developments required to have a stormwater BMP facility:

“Final design calculations for the stormwater BMP facility will require the use of storage indication routing methodology such as TR-20 or HEC-1 models. For the BMP facility, provide stage-storage relationship and inflow and outflow hydrographs. Provide all tabulated data including calculations showing the outlet under orifice control, barrel control and weir control, as appropriate, to show how the routing was developed.”

4. For Developments required to have a stormwater BMP facility:

“An executed stormwater facility operation and maintenance permit agreement (prepared by Stormwater Services, City of Durham), payment of stormwater facility permit fee per BMP facility and perpetual surety for the continued operation and maintenance of the facility is required prior to construction plan approval.”

5. For Developments required to have a stormwater BMP facility:

“An as-built certification for the stormwater BMP(s), provided by the design engineer, is required. The as-built shall be submitted per the Reference Guide for Development, approved by the Stormwater Services Division and the BMP(s) shall be inspected and approved by the Stormwater Services Division prior to issuance of any certificates of occupancy or certificates of compliance for the project.”

6. For Developments required to have a stormwater BMP facility:

“A completed City of Durham Design Summary is required for each stormwater BMP facility no later than at the first construction drawing submittal.”

7. For Developments required to have a stormwater BMP facility:

“Stormwater BMP facility design calculations will not be reviewed or approved with the Site Plan/Preliminary Plat submittal. All stormwater BMP facility designs will be reviewed and approved during the construction drawing submittal process.”

B. Standard Notes: (Note that these notes may or may not apply to the project depending on the requirements of the project, determined during review)

1. Stormwater Drainage Easement Note (Width determined at construction drawings):

“Centerline of _____ foot wide public storm water drainage easement. Ownership of and responsibility for improvement and maintenance of storm water facilities in this easement remains with the current owner. If

the property is within or becomes a part of the City, the easement and access points to the easement are subject to the terms and restrictions stated in the "Revised Declaration of Rights and Privileges of the City of Durham in Storm Water Management Facility Easements" recorded in Real Estate Book 2298, Page 208, which document is incorporated herein. This easement and the Revised Declaration do not create the obligation to provide public maintenance. No building, structures, fills, embankments or obstructions permitted within the easement except according to those terms."

2. Stream Buffer Notes (Width determined at Rezoning or Site Plan):

"_____ foot wide undisturbed stream buffer each side of stream, measured from top of bank. No clearing or grading other than selective thinning and ordinary maintenance of existing vegetation permitted."

3. Floodplain Notes:

"All development within the floodway and floodway fringe, including fill, new construction, substantial improvements, manufactured housing, storage of materials and storage of toxic or flammable substances, is prohibited except as provided by applicable Flood Hazard Regulations."

4. General Notes:

"State and federal permit authorization may be required from the DEHNR and the U.S. Corps of Engineers prior to the commencement of any land disturbing activities in or near a lake, stream, creek, tributary or any unnamed body of water and its adjacent wetlands."

Department of Transportation Notes

Where Streets terminate, add the following note to the construction drawings:

Where streets terminate (example Phase lines) the following will be installed: 1) Asphalt header, 2) Riprap or concrete apron for storm water to dissipate, 3) Utilities to extend a minimum of 5-feet beyond the edge of pavement, 4) NCDOT type III barricade.

Off-site roadway improvements, add the following note to the special conditions of approval box:

By referencing roadway improvements on the plan, the applicant agrees to construct said improvements prior to issuance of certificate of occupancy in a manner that will allow them to function as noted on the plan and in accordance with NCDOT and City of Durham standards and policies. This includes (where appropriate) but is not limited to: adequate transition tapers, alignment of lanes through intersections, associated signal modifications, pavement markings, associated signage, curb and gutter, coordination with other proposed roadway improvements and bike lanes. The applicant also accepts the financial responsibility for acquisition of any additional right-of-way necessary to accommodate these improvements and any required sidewalk construction.

Signs and/or pavement markings to be installed by the developer (new subdivisions or off-site roadway improvements that need new markings for example), add the following note to the special conditions of approval box:

The developer is responsible for fabrication and installation of all required signs and pavement markings within the public right-of-way. The developer shall submit a signing and markings plan to the City at construction plan stage for review and approval. All signs and pavement markings, shown on the construction plans, must be in place prior to the issuance of any certificate of occupancy and/or street acceptance, as determined by the City.

Right-of-way dedication on a major/minor thoroughfare adjacent to the site, add the following note to the special conditions of approval box:

Dedicate an additional ____ feet of right-of-way along the frontage of the site on _____ Road prior to the issuance of any building permit. A copy of the recorded plat must be submitted with the first building permit application.

Bus stop/shelter is to be constructed near the site, add the following note to the special conditions of approval box:

Provide bus shelter with concrete pad on _____ Road. Design specifications and exact location to be reviewed and approved by DATA prior to construction.

Off-site roadway improvements on the site, add the following note to the special conditions of approval box:

All off-site roadway improvements must be complete prior to the issuance of any certificate of occupancy.

Variations to these standard notes may be applied with the express consent of the Transportation Division.

Signage and Marking Plan Construction Drawing Notes:

1. All signs, street markers, and pavement markings (everything called out on the signing and marking sheet) must be installed on each street prior to the issuance of a certificate of occupancy and/or street acceptance, as determined by the City.
2. The street name sign shall be reflective to show the same shape and similar color both day and night. The letters and background shall be of contrasting colors.

3. Street name signs shall have white letters on a green background.
4. Lettering on the street names shall be 4-inches high in capital letters.
5. Suffix lettering to indicate the type of street (such as street, avenue, or road) or the section of the City (such as NW) shall be lettering 2-inches high.
6. Street name signs will be located on top of stop signs in a stacked position.
7. Stop bars shall be 2-feet wide white thermoplastic per NCDOT specifications.
8. All signs must conform with the Manual On Uniform Traffic Control Devices (MUTCD).
9. Street signs shall show block numbers. (Block numbers are shown on the recorded plat. If they are not shown on recorded plat, contact the City's Engineering Assessments Division at 560-4326)

SECTION 13.0

FORMS

This section is intended to provide standard forms, checklists and permit applications that the City of Durham Engineering Division uses when reviewing and approving plats, site plans, construction drawings and permits. These can be reproduced and used as originals. Note that some forms are two-sided.

These forms may be updated periodically. Contact City of Durham Engineering to verify the latest edition is being

Construction Plan Approval Stamp

The stamp below is used on all approved construction drawings (refer to Section 2.1 Construction Plan Approval Process). This is a copy of the City of Durham Engineering approval stamp that is to be placed on the right side of all sheets that are to be sealed and signed off by Engineering.

The applicant shall reproduce this stamp and place it on the drawings so that the originals can be signed.

CITY OF DURHAM PUBLIC WORKS DEPARTMENT APPROVED	
ENGINEERING _____	DATE _____
STORM WATER _____	DATE _____
TRANSPORTATION _____	DATE _____
_____	DATE _____
_____	DATE _____

PDF format - Acrobat Reader required

Forms:

Extension Agreement Application October 2012

License Agreement Application March 2011

Low Water Pressure Acknowledgement Form March 2010

Gravity Sewer permit Application March 2010

Water Permit Application March 2010

Project Information Form March 2010

City of Durham Utility Right of Way Permit Request Form March 2010

Project Construction Information Sheet March 2010

Utility Extension Agreement Application

Date: _____

Instructions

Complete all fields in the application and submit to the City-County Planning Department located on the ground floor of City Hall. Include with the application:

☐ \$200 fee ☐ Utility Plans ☐ Fire Flow Test Results

Owner/Developer Information

Legal Name of Owner or Developer: _____

☐ Corporation ☐ Limited Liability Company ☐ Individual

City of Durham Business Privilege License #: _____

Address: _____

Email Address: _____ Phone#: _____ Fax#: _____

Contact Person: _____ Job Title: _____

Consultant Information

Contact Person: _____ Company Name: _____

Address: _____

Email address: _____ Phone #: _____ Fax #: _____

Project Information

Project Name: _____ Acres: _____

PIN #: _____

Street Address: _____

Project Description/Type and Unit Count: _____

Utility Impact Analysis

A. System Pressure

Q₂₀ from Fire Flow Test (GPM): _____

Required Hydrant Flow for proposed project per Reference Guide (GPM): _____

Required Hydrant Flow (GPM), per Reference Guide, for the highest possible use in this project's service area according to Future Land Use Map (FLUM): _____

Proposed Water Improvements: _____

Are the water system improvements consistent with the FLUM designation? ☐ Yes ☐ No

B. Sanitary Sewer Basin Analysis

Volume of Wastewater Generated by this Project (GPD): _____

Sewer Basin #: _____ Pump Station (if applicable): _____

Water Reclamation Plant: ☐ North Durham, Facility No. NC 0023841 ☐ South Durham, Facility No. NC 0047597

List of Undeveloped Parcels within the Sewer Basin:

PIN	Acres	Future Land Use	PIN	Acres	Future Land Use

Proposed Sanitary Sewer Improvements: _____

Are the sewer system improvements consistent with the FLUM designation? ☐ Yes ☐ No

Who needs to apply for a Utility Extension Agreement?

If you propose to extend the City water or sewer system, you must first enter into a Utility Extension Agreement with the City of Durham. Per Chapter 70 of the City of Durham Code of Ordinances (**Article III, Divisions 2 and 3, Sections 70-95 through 70-129**), water and sewer extensions may be made to serve only properties inside the City or to properties voluntarily annexed into the City. If you are not sure if an agreement is needed, submit to City Engineering a map outlining the tract of land (reference PIN numbers and locate existing and proposed water and sewer lines on the map). City Engineering will review this information and inform you if an agreement is needed or not.

What is submitted?

1. Complete Utility Extension Agreement application
2. Fee: \$200 Check made payable to the City of Durham
3. Fire flow test results
4. Utility plan showing proposed improvements

What is the Approval Process?

Submit applications of new extension agreements, initial zonings and annexations ("consolidated application") to the City-County Planning Department. The information on this application will be used to prepare the Extension Agreement. The Agreement will be emailed back to you for signatures and notarizations. Return a signed and notarized copy of the agreement to City Engineering (3rd floor of City Hall). The consolidated application will be submitted to the City Council agenda system for ultimate approval.

How can I obtain a Business Privilege License #

If the owner does not already have a business license, the owner must obtain a business license from the City Finance Department: <http://durhamnc.gov/ich/as/fin/Pages/Business-Privilege-License.aspx>.

Where can I download the Reference Guide?

The City's Reference Guide for Development can be downloaded here: <http://durhamnc.gov/ich/op/pwd/Pages/handbook.aspx>



Utility Extension Agreement Application for Single-Family Residence

Date: _____

Instructions

According to Chapter 70, Article III Sections 70-95 and 70-109 of the [Durham City Code of Ordinances](#), connection to the City's water and sanitary sewer lines (services) may be made to serve only properties inside the city or to properties voluntarily annexed into the city. If you are proposing to connect to City water and sewer and your property is located outside the City limits, you must enter into a Utility Extension Agreement with the City and submit a petition for annexation into the City. The Extension Agreement and annexation petition will require approval from the City Council. Contact the Budget and Management Services Department for information on how to apply for annexation (919-560-4111 and website: <http://durhamnc.gov/ich/as/bms/Pages/Annexations.aspx>). Submit both the extension agreement application and annexation petition as a "consolidated application" to Scott Whiteman in the City-County Planning Department (ground floor of City Hall).

Utility connections must be made to both water and sewer.

Complete all fields in the application and include with the application:

☐ \$200 fee ☐ Plot Plan

Owner Information

Owner's Name: _____

Address: _____

Email Address: _____ Phone#: _____

City of Durham Business Privilege License #: _____

You can obtain a business license from the City Finance Department at 919-560-4700 or
<http://durhamnc.gov/ich/as/fin/Pages/Business-Privilege-License.aspx>.

Property Information

Property Pin #: _____

Street Address: _____

Both Water and Sanitary Sewer are available to the property? ☐ Yes ☐ No ☐ Unknown

Proposed Utility Work (examples: *Need to extend water or sewer to serve the property or Need service line to connect to existing utilities*): _____

City of Durham Public Works – Engineering
101 City Hall Plaza Durham, NC 27701
Phone: (919) 560-4326 Fax: (919) 560-4316



License Agreement Application

Submit the Form, 1 set of construction drawings, and a fee of \$200.00, in check form, made payable to the City of Durham.

Date: _____ ☐ \$200 fee ☐ 1 Set of Construction Drawings

Project Information

Project Name: _____

PIN #: _____

Street Address: _____

Description of proposed improvements inside right-of-way: _____

Applicant Information

Name of Applicant: _____ Title: _____

Applicant Address: _____

Email address: _____ Phone #: _____ Fax #: _____

Owner Information

Legal name of party (owner of improvement inside ROW) entering into agreement (be specific):

☐ Corporation ☐ Limited Liability Company ☐ Individual

Business License #: _____

Name of Representative: _____ Title: _____

Party's Address: _____

Email address: _____ Phone #: _____ Fax #: _____

Officers of agreement party, if applicable:

President: _____

Vice-President: _____

Secretary: _____

Treasurer: _____

Managing Partner: _____

(Print Name)

(Signature)

Who needs to apply for a License Agreement?

If you propose to cross or encroach on any City of Durham street right-of-way (ROW) with a private sign, street feature (i.e. special pavers, decorative pavement markings) or a private utility (irrigation line, electrical line, etc....) a License Agreement with the City of Durham is required. This includes new developments currently under review or construction.

How do I know if I need a License Agreement?

If you are not sure if an agreement is needed submit to City Engineering a map outlining the tract of land (reference tax map numbers; project name) and locate existing streets and ROW that is to be crossed. The City Engineering Department will review this information (normally within 1 week unless there is unusual circumstances) and contact you if an agreement is needed and if plans need to be submitted. Please do not forget to indicate how we are to get back in touch with you.

What is submitted?

1. Complete the License Agreement application
2. Fee: \$200.00 check made payable to the City of Durham
3. Construction drawings (see below for construction plan requirements).

Approval Process

The information on the application will be used to prepare a License Agreement. The License Agreement will be emailed back to you for signatures and notarizations. Print three copies and sign and notarize each one. Return the signed Agreements back to City Engineering (3rd floor of City Hall) where it will be submitted to the City Council agenda system for ultimate approval. Council approval is required before construction can begin. Since the City Council agenda cycle can take over a month we recommend that the License Agreement application be submitted as soon as possible.

What are Construction Drawings?

Construction drawings are plans that identify the encroachment in the ROW on 8 ½"x11" sheets of paper. One set of construction drawings should be submitted to City Engineering for review. Upon completion of review (usually within two weeks unless there is something unusual about the project then it could take longer) the plans will be returned for corrections. Some corrections require an additional submittal and review. These drawings will become part of the License Agreement. There is to be a plan view and a cross section of the proposed encroachment.

Plan View (minimum layout information)

Title Block with applicant and owner information; Vicinity Map or show nearest cross street; North Arrow; Scale; Location of all existing utilities (sizes and material) with locations dimensioned; Street names; Location of edge of street with dimensions; Type of street (curb and gutter, gravel, etc...); Proposed improvement (perpendicular crossing of ROW) dimensioned to street; Carrier pipe to extend beyond ROW; Irrigation lines to be copper within ROW; Irrigation lines to have a manual control valve located just outside of the ROW on the supply side of the line; Irrigation lines to show spray heads located outside of ROW with spray patterns (no spray patterns onto roadway); For irrigation of traffic islands show trench drains and slotted PVC pipe installed behind all curb in the island and discharging into a storm inlet or to daylight; No proposed pedestals or manholes inside ROW.

Cross Section View

Existing top of grade (curb lines, pavement...etc.) across ROW; Existing water, sewer or other underground utility that must be crossed with dimensions of depth and dimensions relative to each other; Carrier pipe to extend beyond ROW; show proposed pedestals or manholes if needed outside of ROW.

Business License #

Obtain a business license from the City Finance Department:

http://www.durhamnc.gov/departments/finance/business_license.cfm.

Do not hesitate to contact us if you have any questions at 919-560-4326.



Low Water Pressure Acknowledgement Form

This document applies only to those properties that the City has designated as being in an area of potentially low water pressure. This document is not available for use in areas other than those so designated.

Date: _____

Project Information

Project Name: _____

PIN #: _____

Street Address: _____

Low Water Pressure Acknowledgement

To better serve the community, we are alerting builders/owners/designers that in certain sections of Durham there is a potential for having low water pressure and that a booster pump may be needed to improve service to the site. The site referenced above is in the area designated as potentially having low pressure. City of Durham requires that the applicant be made aware of this potential and that the applicant acknowledges that either a booster pump will be installed or they will be required to explain why one is not needed.

Be advised that a booster pump will require a back flow device and a separate permit from Cross Connection (560-4194). If a booster pump is installed it is the applicants responsibility to contact Cross Connection and apply for a permit.

By my signature below I acknowledge that a booster pump may be needed to provide adequate domestic service and/or fire flow to the site referenced above. I further acknowledge that if I choose NOT to install a booster pump that I and my successors will not hold the City of Durham liable for any complications or damage that may result from low water pressure.

Will Booster Pump be installed: ☐ Yes ☐ No

If No, explain: _____

Print Name: _____

Title (owner/designer/builder, etc.): _____

Signature: _____ Date: _____

Gravity Sewer Extension Permit

Submit this **original**, 2 sets of approved plans and fee of \$450.00, in check form, made payable to the City of Durham. Note: If the proposed system contains public and private sewer mains, separate permit forms, fees, and approved plans must be provided (i.e. one application, \$450.00 check, 2 sets of approved plans for public and one application, \$450.00 check, and 2 sets of approved plans for private).

Date: _____ Permit #: _____ (Assigned by the City)

Project Information

- | | |
|---|--------------------------------------|
| 1. _____
(Project Name) | 2. _____
(Project Tax Map Number) |
| 3. _____
(Project Address) | 4. _____
(Pin#) |
| 5. Public: <input type="checkbox"/> Private: <input type="checkbox"/> | |

Developer Information

- | | |
|---|---|
| 6. _____
(Developer's Company Name) | |
| 7. _____
(Developer's Address) | |
| 8. _____
(Developer's Telephone Number, include area code) | 9. _____
(Developer's Fax Number, include area code) |
| 10. _____
(Print or Type Name of Developer's Representative) | 11. _____
(Title) |
| 12. _____
(Signature) | 13. _____
(Date) |

Engineer Information

The undersigned engineer certifies that said plans and specifications have been prepared in compliance with all applicable requirements.

- | | |
|---|---|
| 14. _____
(Engineer's Name) | 15. _____
(Engineer's Company Name) |
| 16. _____
(Engineer's Company Address) | |
| 17. _____
(Engineer's Telephone Number, include area code) | 18. _____
(Engineer's Fax Number, include area code) |
| 19. _____
(Engineer's Email) | |

Permit Information

20. Project is ☐ New; ☐ Renewal; ☐ Modification.

If Renewal or Modification, existing Permit No.: _____ Issue Date: _____
(Contact Water & Sewer Engineering at (919) 560-4326 for proper procedure.)

21. Project is: ☐ Public; ☐ Private.
If private, applicant will be: ☐ Retaining Ownership ☐ Selling Units (provide DWQ DEV 02/03 Form*)

* Form DEV 02/03 Division of Water Quality (DWQ) Web Link: <http://h2o.enr.state.nc.us/ndpu/md3.doc>

22. Water Reclamation Facility: ☐ North Durham, Facility No. NC 0023841
☐ South Durham, Facility No. NC 0047597
23. Volume of wastewater generated by this project: _____ Gallons per day.
 _____ % Domestic _____ % Commercial _____ % Industrial
 _____ % Other (specify): _____
24. Explanation of how wastewater volume and makeup was determined: _____

25. If wastewater is other than domestic in nature, has a pretreatment application been approved by the City of Durham Department of Water Resources? Yes ☐ No ☐

Design Information

26. Brief project description: _____

27. Summary of sewer pipe by diameter and pipe material. Indicate here whether C factor or N factor is used and circle C or N below: Note length in this table is the total length of sanitary sewer lines of a specific size and material. (i.e., 2000' of 8" PVC main, 400' of 8" DIP)

Diameter (in.)	Length (ft.)	Pipe Material	C or N Factor	Minimum Slope %	Maximum Slope %	Max. Vel. (fps)
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

Note: The minimum velocity must not be less than 2.5 fps, the minimum diameter for public sewer mains is 8-inches, and the minimum slope for 8-inch diameter mains is 0.5%.

28. Anchors shall be provided for sewers with slopes greater than 20%. The anchor spacing shall be as follows:
- a. 36 foot separation for slopes of 21% to 35%.
 - b. 24 foot separation for slopes of 36% to 50%.
 - c. 16 foot separation for slopes of 51% or greater.

For velocities greater than 15 fps, erosion control measures must be specified to protect the sewer lines and manholes.

If required, have anchors and/or erosion control measures been specified and detailed on these plans?
 Yes ☐ No ☐

29. Is sewer subject to existing or planned traffic bearing loads? Yes ☐ No ☐
 If yes, have measures been taken to enable sewer to withstand the loads? Yes ☐ No ☐
30. Maximum sewer reach length between manholes is _____ lineal feet (400' max.)
 Does the owner/operator have the ability to clean this length? Yes ☐ No ☐
31. Does minimum cover for sewer mains and/or outfalls satisfy the following requirements?
- a. 4 ft. minimum cover over all sewer outfalls? Yes ☐ No ☐
 - b. 5 ft. minimum cover over all sewer mains? Yes ☐ No ☐
 - c. 3 ft. minimum from rim to finished grade. Yes ☐ No ☐
- (except in floodplain or maintained areas as determined by City of Durham Engineering Division).
32. Are all manhole invert in and out elevations, as well as rim or top elevations, shown on the plans? Yes ☐ No ☐

33. Are all inverts in and out within 0.5 feet maximum difference? Yes ☐ No ☐
34. Are outside drop manholes provided where invert separations exceed 0.5 feet? Yes ☐ No ☐
 (minimum vertical separation for 8-inch drop connections is 2.0 feet)
 Have the manholes been identified clearly on the dwgs. and details submitted Yes ☐ No ☐
35. Maximum allowable infiltration/exfiltration test rate must not exceed 100 GPD/pipe diameter inch/mile. Does this project meet this requirement? Yes ☐ No ☐
36. Minimum separation distances as shown on the plans or addressed in the specifications.
- a. 100 foot horizontal separation from wells or other water supplies. Yes ☐ No ☐
- b. 12-inch vertical separation from storm sewer Yes ☐ No ☐
 OR ferrous pipe sanitary sewer specified. Yes ☐ No ☐
- c. 10-foot horizontal separation from water mains Yes ☐ No ☐
 OR 18-inch vertical separation Yes ☐ No ☐
 OR ferrous pipe sanitary sewer specified. Yes ☐ No ☐
37. Are manholes subject to flooding? Yes ☐ No ☐
- If yes, are manhole rim elevations 2.0 feet above the 100-year flood level? Yes ☐ No ☐
 OR are the manholes vented and water tight? Yes ☐ No ☐
- If yes, is 100-year flood level shown on plans? Yes ☐ No ☐
38. Does this project have any stream crossings? Yes ☐ No ☐

If yes, have precautions or special features been utilized to ensure protection of the sewer line and not restrict flow? Identify the sheet of the plans and station number where stream crossings are located: _____

Applicant's Certification

I, _____, attest that this application for _____

has been reviewed by me and is accurate and complete to the best of my knowledge. I understand that if all required parts of this application are not completed, and that if all required supporting information and attachments are not included, this application package will be returned as incomplete.

Signature _____ Date _____

Professional Engineer's Certification

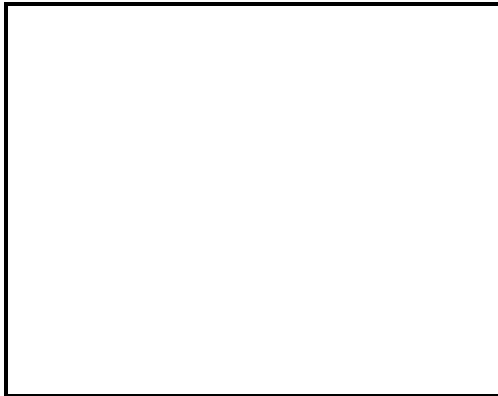
I, _____, attest that this application for _____

_____ has been reviewed by me and is accurate and complete to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations. Although certain portions of this submittal package have been developed by other professionals, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

Name of Engineer (please print): _____

North Carolina Professional Engineer's Registration Number: _____

Seal and Signature: _____ Date _____



Seal

PERMIT

This section to be completed by the City of Durham

The plans and specifications cited in the foregoing application are hereby approved pursuant to Article IX of Chapter 23 of the Durham City Code, under the authority granted by the certification of the City of Durham's permitting program by the North Carolina Department of Environmental, Health and Natural Resource.

By: _____ Title: _____ Date: _____



Water Extension Permit

Submit this **original** with 2 Sets of approved plans and submittal fee of \$450.00 in check form made payable to City of Durham. Note: If the proposed system contains public and private water mains, separate permit forms, fees, and approved plans must be provided (i.e. one application, \$450.00 check, 2 sets of approved plans for public and one application, \$450.00 check, 2 sets of approved plans for private).

Date: _____ Permit #: _____ (Assigned by the City)

Project Information

- | | |
|---|--------------------------------------|
| 1. _____
(Project Name) | 2. _____
(Project Tax Map Number) |
| 3. _____
(Project Address) | 4. _____
(Pin#) |
| 5. Public: <input type="checkbox"/> Private: <input type="checkbox"/> | |

Developer Information

- | | |
|---|---|
| 6. _____
(Developer's Company Name) | |
| 7. _____
(Developer's Address) | |
| 8. _____
(Developer's Telephone Number, include area code) | 9. _____
(Developer's Fax Number, include area code) |
| 10. _____
(Print or Type Name of Developer's Representative) | 11. _____
(Title) |
| 12. _____
(Signature) | 13. _____
(Date) |
14. The developer listed above is herewith making application to the City of Durham for the approval of said plans and specifications for the installation, construction or alteration of (give brief description of proposed project):
- _____
- _____

Engineer Information

The undersigned engineer certifies that said plans and specifications have been prepared in compliance with all applicable requirements.

- | | |
|---|---|
| 15. _____
(Engineer's Name) | 16. _____
(Engineer's Company Name) |
| 17. _____
(Engineer's Company Address) | |
| 18. _____
(Engineer's Telephone Number, include area code) | 19. _____
(Engineer's Fax Number, include area code) |
| 20. _____
(Engineer's Email) | |
| 21. _____
(Engineer's Signature) | 22. _____
(Date) |
| | 23. _____
(Seal) |

PERMIT

This section to be completed by the City of Durham

The plans and specifications cited in the foregoing application are hereby approved pursuant to Article IX of Chapter 23 of the Durham City Code, under the authority granted by the certification of the City of Durham's permitting program by the North Carolina Department of Environmental, Health and Natural Resources pursuant to the North Carolina Drinking Water Act.

By: _____ Title: _____ Date: _____



Project Information Sheet

Submit this **original** form with 4 sets of approved plans.

Date: _____

Project Information

Project Name: _____ Phase: _____
PIN #: _____ Site Plan Case #: _____
Legal owner name: _____
Mailing address: _____
Email address: _____ Phone #: _____ Fax #: _____
Engineer/Architect: _____
Mailing address: _____
Email address: _____ Phone #: _____ Fax #: _____

Street Utilities

Public

Street: _____ (LF)

Water Main	Size (in)			
	Length (LF)			
Sewer	Size (in)			
	Length (LF)			
Storm Sewer	Size (in)			
	Length (LF)			

Private

Street: _____ (LF)

Water Main	Size (in)			
	Length (LF)			
Sewer	Size (in)			
	Length (LF)			
Storm Sewer	Size (in)			
	Length (LF)			

Sewer Outfall _____ (LF)

Force Main _____ (LF)

Total # of dwelling units _____

Sewer Outfall _____ (LF)

Force Main _____ (LF)

Proposed flow _____ (gdp)

Instructions Streets: Measured along centerline from face of curb or edge of pavement whichever is applicable. Measure straight through cul-de-sac.
Water mains: Total of all mains 4" and larger.
Sewer Mains: Total of all mains, 6" and larger, with manholes (services not included).
Storm Sewer: Total of all piping 10" and larger
Phase: Fill out a separate sheet for each phase or section if separate invoices are desired for each phase

Water and Sewer Frontages

Existing Water & Sewer Extension Agreement? Yes ☐ No ☐ Date of Agreement _____

Property's frontage on **existing roads** (list frontage of each road separately):

Street Name

Property's Frontage*

* Measure along existing right-of-way line. Do not include right-of-way for intersecting public streets.

Stormwater Maintenance Agreement

Stormwater Maintenance Agreement required? Yes ☐ No ☐

Right-of-Way Utility Excavation Permit Request

Failure to submit this form and the required plan sheets with complete and accurate information (print or type) can delay the approval process. If deemed necessary, the request will be returned to the applicant for revisions. Excavation in ROW without a permit may result in Stop-Work Orders and/or delays in permitting.

Date: _____

Checklist

Include the following required plans with the permit form:

- | | |
|--|---|
| <input type="checkbox"/> 2 hard copies of plans | <input type="checkbox"/> 1 electronic copy of plans |
| <input type="checkbox"/> Trench profile (if combined trench) | <input type="checkbox"/> Combined-trench permit |
| <input type="checkbox"/> Secondary applicant(s) (attach authorization letter): _____ | |

Applicant Information

Prime Applicant: _____ Applicant Project #: _____
Street Address: _____
City: _____ State: _____ Zip: _____
Telephone #, include area code: _____ Facsimile #, include area code: _____
Email address: _____
Subcontractor: _____ NC Contractor Lic. #: _____
Telephone #, include area code: _____ Email address: _____
24-hour Emergency Phone # with area code: _____ Contact Person: _____

Location of Work

Street Name	Subdivision/Development name/phase:
_____	_____
_____	Street, between: _____ and _____
_____	Street, between: _____ and _____
_____	Street, between: _____ and _____
_____	Street, between: _____ and _____
_____	Street, between: _____ and _____

Description of Work

Utility type: ☐ Electrical conduit ☐ Telecommunications cable ☐ Gas line
☐ Other _____

Total Length: _____ Number and Size: _____

Type of Excavation: ☐ Bore ☐ Trench ☐ Pavement/Street Cut – L _____ W _____
☐ Other _____ ☐ Sidewalk/Driveway Cut – L _____ W _____

Dimensions of proposed excavation in City Right-of-Way: L _____ W _____ D _____

Proposed Traffic Control: ☐ Detour ☐ Lane Restriction ☐ Other _____

Start Date: _____ Duration of Construction: _____

Reason for Work: _____

Signature of Applicant: _____ Date: _____

SECTION 14

ENGINEERING DEVELOPMENT FEES

This section is intended to aid in the process of determining Engineering fees that may be associated with the project. Contact other departments and agencies (i.e. Planning, Building Inspections, Durham County Erosion Control, Durham County Sewer etc.) to get a listing of these fees.

I. Water and Sanitary Sewer Charges:

A. Frontage Charges:

These fees are applicable when property is developed and a water and/or sanitary sewer line has not been installed by the developer or property owner across the street frontage or street right-of-way abutting the project. These fees are paid when the mains are extended for new projects. If no extension is made frontage charges are paid with the application for service. The rates below are effective since **May 1, 2010**.

The current frontage charges are:	Water	Sewer Sanitary
Inside City Limits	\$27.00/LF	\$50.00/LF
Outside City Limits	\$29.50/LF	\$56.00/LF

B. Capital Facilities Fees:

Are due prior to connection. Typically, these fees are paid with the application for the service connection. The fees below are required per Section 23-40.1 of the Ordinance and shall be in full force and effect of September 1, 2010.

The current capital facilities fees are:

Meter Size (Inches)	Water	Sanitary Sewer	Total
5/8	\$1,524	\$915	\$2,439
1	\$3,417	\$2,286	\$5,703
1 ½	\$6,571	\$4,573	\$11,144
2	\$10,354	\$7,316	\$17,670
3	\$22,339	\$16,004	\$38,343
4	\$63,339	\$45,726	\$109,055
6	\$126,414	\$91,452	\$217,866
8	\$221,028	\$160,041	\$381,069
10	\$347,178	\$251,493	\$598,671
Over 10 (per gpd)	\$4.53/gpd	\$3.05/gpd	\$7.58/gpd

Note: Fees are subject to change without notification

C. Meter and Service Charges**:

1. Water Meter Actual Costs (existing service and meter box or vault)

Meter Size (Inches)	Pick-Up	Installed by City
5/8	N/A	\$180.00
1	N/A	\$270.00
1 ½	\$490.00	\$500.00
2	\$605.00	\$750.00
3	Actual Cost	Actual Cost
4	Actual Cost	Actual Cost
6	Actual Cost	Actual Cost
8	Actual Cost	Actual Cost
10	Actual Cost	Actual Cost
12	Actual Cost	Actual Cost

These fees are applicable for existing services that need a meter set with new development with the developer installing the mains and services. Please contact Engineering Services (919-560-4326) for actual cost of meters.

For infill lots and single lot Developments call Engineering Services for information on City installed Water and Sanitary Sewer Services.

Note: Fees are subject to change without notification

II. Other Charges

A. Construction Drawing Review Fee (Paid at time of initial submittal)

- i) For plans containing Plan and Profile sheets \$1,200.00
- ii) For all other plans \$500.00
- iii) For plans submitted during actual Construction related to field/modifications \$500.00 or \$1,200

B. Extension Agreements License Agreement (Paid at time of application submittal) \$200.00

C. Fire Flow Test Request (Paid prior to actual test) \$850.00

D. Water Extension Permit* (Paid at time of permit application submittal) \$450.00

E. Sewer Extension Permit* (Paid at time of permit application submittal) \$450.00

F. Construction Inspection Fees (Public and Private)

Street	\$2.00/LF
Water Main	\$1.00/LF
Sanitary Sewer Main	\$1.00/LF
Sanitary Sewer Outfall	\$1.00/LF

G. Drainage System Inspection Fees (Effective July 1, 2010)

Stormwater Pipes	\$1.00/LF
Stormwater Open Channel	\$0.50/LF

H. Driveway, Right-of-Way Excavation:

• driveways	\$80
• street cuts	\$80
• sidewalks	\$80
• cow horn irrigation	\$80
• any other single permit one time inspection that does not have an established fee	\$80

I. Re-inspection Fees

Effective on July 1, 2010, a fee of \$100 for each re-inspection is charged as follows:

- All inspection visits starting with the third inspection for single inspection driveways, street cuts, sidewalks, cow horn irrigation or other single permit one time inspections.
- All inspections visits starting with the third inspection for final right-of-way inspections performed by Public Works on building permits or any Land Office Development (LDO) related inspections.

J. Storm Water Items

Storm Water Facility Permit \$3,500.00/facility

Surety bond amounts are determined by Stormwater Services.

K. Impact Fees:

Determined at the time of application for building permit by the Inspections Department

Note: Fees are subject to change

****After May 1, 2010***